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AUSCULTATION AND PERCUSSION

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A TABULAR HANDBOOK

OF

AUSCULTATION AND PERCUSSION.

For Students and Physicians.

BY

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WITH FOUR PLATES.

"*Nollem esse medicus sine auscultatione et percussione.*"
CORVISART.

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PREFACE.

In the preparation of this little book, I have consulted the works and compared the views of many who have been eminent in the physical exploration of the chest, such as Laennec, Avenbrugger, Corvisart, Piorry, Skoda, Barth and Roger, Walshe, Hope, Stokes, Fuller, Grisolle, Bennett, Latham, Flint, Balfour, Hayden, Ziemssen, Fothergill, and Loomis, and here desire in a general way to acknowledge my indebtedness to them, as it has seemed impossible to do so in the text in each instance.

Since the illustrious Laennec discovered the art of auscultation in 1816, very many investigations have been made and much has been written on the subject. While on the one hand it is perfectly surprising how little the master mind of Laennec left to be done, and how many of his descriptions, classifications, and meanings of sounds still remain unimproved upon in spite of sharp criticism, yet on the other hand, as would naturally be expected, other experimenters since have discovered new facts, and by a wider experience have been able to point out more or less error here and there in the works of the father of auscultation. I have endeavored to give, arranged in tabular form, a condensed summary of the most authentic observations down to the present time.

As to the theories of the *mechanism* of the production of some of the sounds, there has been a great deal of controversy, in which Skoda with his "consonance" and "tension" and other theories has taken quite a prominent part. Those theories have been given in the following tables which seem most rational and which are at present most generally accepted.

In the *nomenclature* of the physical signs, care has been taken not to use those terms which merely express somebody's theory of their mode of production. Skoda's "consonating râle," for instance, is a very ill-advised term, as the theory of consonance is far from being universally accepted, and no one who rejects the theory would like to use such a term. Even the common term "mucous râle" has been made to give place to the much more expressive "bubbling râle," which does not imply that it is always caused by mucus, but leaves room for its production sometimes also by pus, serum, softened tubercle, etc.

To avoid confusion, and for the convenience of those who may have become familiar with some particular authority, many of the synonyms have been added in small type in parentheses.

In determining what *classification* to follow, it has been thought desirable to avoid the excessive and complicated refinements of some authors, without, on the other hand, losing sight of the necessity for sufficient thoroughness.

There has been an effort to make the *arrangement* of material in the following tables so systematic, that any special point needing investigation can be immediately referred to, without a tedious and laborious

search through many pages and perhaps many volumes. The condensed tabular arrangement will be found especially advantageous also in differential diagnosis, as it brings into such close juxtaposition information which is usually widely scattered, rendering comparison easy, point by point.

Studied in connection with Chapter IV. of Da Costa's excellent work on Diagnosis, with its graphic descriptions and convenient, helpful diagrams, these tables will probably furnish the student with all that is really necessary in the majority of cases coming under observation. If, however, he desires to make a special study of the subject, he is referred to the two large and valuable treatises on the "Diseases of the Respiratory Organs" and "Diseases of the Heart," written by Dr. Austin Flint of New York, who is probably the greatest authority on the physical diagnosis of such diseases in this country, and to whom I desire to acknowledge myself especially indebted. It should be remembered, however, that the pathology of these works is not quite up to date.

It is also hoped that this handbook may be found useful by physicians in active practice. It is hardly to be expected that practitioners who do not make a specialty of lung and heart diseases, even if they have at some time carefully studied into the subject, and have been well posted, can retain in their memories for immediate use at all times every point necessary for a delicate physical diagnosis. If the case be at all obscure, they feel the necessity of consulting some authority. In such emergencies, the busy doctor may appreciate such a time and labor saving contrivance as the present. It often needs only a word here and there to revive memories of extensive reading.

It is very doubtful if at this late day any well educated physician could be found to despise the value of auscultation and percussion as aids to diagnosis. Such a contempt would at once stamp the man who showed it as an ignorant pretender. But there are many who do not feel thoroughly at home in this branch, and on account of too slight practical acquaintance with it, and lack of time or inclination for a laborious research into its theory, prefer to trust for the most part to the symptoms alone rather than to the uncertainties (to them) of physical signs. Here most truly "a little knowledge is a dangerous thing." For if the practitioner, finding jerking respiration, for example, in a given case, knows that jerking respiration is a sign of phthisis, and does not remember that it may be a sign of several other diseases too, and on the strength of this sign alone diagnosticates the case as phthisis, it would, indeed, be far better for him to have known nothing whatever of auscultation and percussion, and to have been guided entirely by the symptoms. It is such partial knowledge, to say nothing of the utter ignorance of others, that has to some extent brought auscultation and percussion into disrepute in certain places.

It is very desirable to have a proper appreciation of the comparative value of physical signs and symptoms, without enthusiastically overestimating either. He who trusts to symptoms alone for his diagnosis of heart and lung diseases will very, very often be led astray. On the other hand, the mistake may be made in the opposite direction of placing too exclusive reliance on physical signs alone. In fact, they must be taken together and complement each other. If they

are, and proper attention is paid to the history of each case, and also to its well-known pathological laws, an accurate diagnosis can be made in the great majority of instances.

When speaking of heart diseases, Da Costa says: "A knowledge of the physical signs is the solid foundation, without which any structure that may be reared will soon tumble to pieces."

In fact, the *symptoms* of heart disease are comparatively insignificant. Quite so much cannot be said of the comparative value of signs and symptoms in lung diseases; but even here the great importance of the former is attested by the immense strides which have been made in the diagnosis of such affections since the discovery of the present methods of physical exploration, which would have been utterly impossible before.

The plates have been reproduced (with slight alterations), by the "direct transfer" process, from the "Handbuch und Atlas der topographischen Percussion," by Professor Weil of Heidelberg, published at Leipzig in 1877.

H. C. CLAPP.

544 TREMONT STREET, BOSTON, *October* 3, 1878.

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INTRODUCTION.

Pathognomonic physical signs are exceedingly rare. It is not true that each disease has belonging to it one or more individual signs like labels, which are always associated with it and no other. The nomenclature of diseases is not so rigidly prescribed by nature as it would be in such a case. Physical signs, instead of representing individual diseases, represent merely physical conditions which may be common to several diseases. For instance, dullness on percussion, bronchial or broncho-vesicular respiration, bronchophony, and increased vocal fremitus in combination would indicate solidification of the lung, but they do not tell us on what the solidification depends. It may be pneumonia, it may be phthisis, it may be collapse of pulmonary lobules, it may be lung tissue compressed by a pleuritic exudation. The disease, the particular cause of the solidification, we have to reason out from the presence or absence of other physical signs, from our knowledge of pathology, and from the history and symptoms of the case.

Before beginning the study of auscultation and percussion, the student should be thoroughly posted in the anatomy and physiology of the organs of respiration and circulation. Then naturally follows the topography of these organs. As an aid in constantly

keeping before the mind this topography, which is of very great importance, especially in the diagnosis of heart diseases, the plates have been added to this volume, and should be carefully studied and often referred to. The details of pictorial illustrations are easier for most persons to remember than long verbal descriptions, no matter how accurate they may be.

For convenience in localizing, recording, and comparing signs, the surface of the chest has been mapped out into anterior, lateral, and posterior *regions*, right and left, as follows: —

Anteriorly — The *supra-clavicular region*, extending from the clavicle upwards a distance varying from half an inch to an inch and a half; *clavicular*, the space occupied by the clavicle; *infra-clavicular*, between the clavicle and the third rib; *mammary*, between the third and sixth ribs; *infra-mammary*, below the sixth rib; *supra-sternal*, the hollow space above the sternum; *superior-sternal*, under the sternum above the third rib; *inferior-sternal*, under the sternum below the third rib.

Laterally — The *axillary region*, having for its lower boundary a horizontal extension of the lower boundary of the mammary region; *infra-axillary*, below this line.

Posteriorly — The *scapular region*, the space occupied by the scapula, extending also to a horizontal line drawn through its lower angle; *infra-scapular*, below this line to the twelfth rib; *inter-scapular*, between the inner margin of the scapula and the spinal column.

It is very essential that the *healthy sounds* of auscultation and percussion should become thoroughly

familiar to the student before he spends much time on the morbid sounds. And yet, there is a constant tendency to hurry over and neglect the former for the sake of getting at the practical work of the latter. No one would undertake to tune a piano without being so familiar with the true tones that he could recognize the least departure from them. Very often in the most important cases brought to the physician, where there is the greatest desire for information, as, for example, in the detection of the very beginnings of phthisis, the deviations from the normal sounds are so slight as to be entirely disregarded by those who do not know by practice exactly what the normal sounds in the different regions of the chest ought to be. And even where one thinks he knows this, constant reference to the healthy standard is necessary.

Auscultation is said to be immediate when the unassisted ear is applied to the chest of the patient, and mediate when a *stethoscope* is used. Both methods are in use, and it is very desirable to become practically familiar with each. Some physicians think that they can hear as well with the unassisted ear as with the stethoscope; but the great majority of those who have much to do with auscultation give a very decided preference to that instrument. Those who have used a stethoscope for any considerable length of time very seldom like to give it up. It is often preferable on grounds of delicacy when examining lady patients, and the avoidance of too close contact which it insures is certainly pleasanter to the examiner, when the patient happens to be at all uncleanly. Besides, it can be applied to certain places (such as the hollow over the clavicle, for instance) to which it

is difficult or impossible to adjust the ear. With it, also, particular sounds, which we may wish to locate definitely and to hear as far as possible unmixed with others (as, for instance, valvular murmurs), can be circumscribed. With *Cammann's double or binaural stethoscope*, which is the best, the sounds are intensified and made more distinct, and some are rendered audible which would be inappreciable to the unassisted ear. At first, until one gets accustomed to it and learns how to use it, there is a disagreeable humming or buzzing which is very confusing, but this soon passes off. The pectoral extremity should be closely applied with moderate pressure, and the edges should fit the skin exactly all around, not being tilted up at one side to allow the air to enter. The room should be quiet and there should be no friction between the stethoscope and the clothing. Stiff hair on the chest under the instrument often occasions a sound which might be confused with the crepitant râle. Beginners almost always get the ear-pieces in the wrong way. They should follow the direction of the auditory canal. The stethoscope should be applied to the bare skin. When the unassisted ear is used, it is pleasanter to have over the chest one thickness of soft cloth, like the undergarment, or a towel. When an accurate examination in a doubtful case is desired, it is utterly impossible to make it without removing the most, if not all, of the clothing from the chest; and the man who, in such a case, gives two or three raps, puts his head down over a stiffly starched shirt or creaking corsets or rustling silk, and then solemnly and oracularly pronounces an opinion, is generally acting ignorantly or dishonestly by his patient. It might almost

be said that if the intra-thoracic noises are all so loud that they can be heard above the noise which the outside clothing makes, it is not of very much importance to the diagnosis that they be heard at all, for in such conditions the symptoms are generally enough. The great danger in listening through all the clothing is that of not hearing (or mixing up) delicate and important signs. In many cases, where the problem is to decide whether or not phthisis is present, it is sufficient to unbutton the upper part of the clothing and turn it aside so as to expose the infra-clavicular regions for examination, as phthisis generally attacks these regions first. But even here, if no deposit be found, particular thoroughness demands a further search.

In immediate auscultation it is advisable to close one ear with the finger to exclude outside noises, and particularly when studying vocal phenomena. In the latter case, besides, the patient should turn his head to one side and put his hand up to his mouth to prevent the auscultator's confusing his voice coming directly from the mouth with the vocal resonance coming through the chest. The auscultator should also avoid stooping over too much when listening, as the congestion of blood caused by such a position dulls somewhat the acuteness of hearing. Unless too weak, the patient is best examined in the sitting posture, with his arms hanging down for the anterior portion of the chest, raised and crossed over his head for the lateral regions, and crossed with the body bent forwards for the posterior regions. Generally he has to be instructed to breathe harder than usual, and often has to be shown how to breathe properly. In children

it is easy to judge of the vocal resonance when they cry. Finally, one side of the chest should be constantly compared with the other, portion by portion.

Percussion, as a method of diagnosticating disease, was discovered by Avenbrugger, whose researches were published at Vienna in 1761. They attracted but little attention, however, until Corvisart fifty years afterwards translated them into French and introduced the practice into the French hospitals. Percussion, like auscultation, is both immediate and mediate. The immediate (which was the only method known to Avenbrugger and Laennec), where the chest was struck directly by the fingers, is now never resorted to, having been entirely superseded by the invention by Piorry of mediate percussion, which interposes some solid substance, called a pleximeter, between the chest and the percussing agent. For this purpose, little plates of ivory or wood with handles have been used, or a flat piece of common elastic India rubber. The best pleximeter, however, is a tapering cylinder of hard rubber or gutta-percha about two inches long, flanging at each end, one circular end-piece being smaller than the other for application to the intercostal spaces and supra-clavicular regions, the body of the cylinder (which is applied to the chest at right angles) making an excellent handle. The best percussor is a little hammer with a hard rubber rod or handle which can be detached from the head, which is made of brass and tipped with soft rubber. Most physicians use for a pleximeter the left middle or forefinger, with its palmar surface applied to the chest, and for a percussor the right middle or forefinger (or both together), bent so as to

strike at a right angle. Although it takes considerable time and practice to become really expert in percussing with the fingers, much more than with the instruments just described, yet everybody should learn this method, as it is a very valuable one, and the instruments cannot always be at hand to be depended upon. Where one has a great deal of percussing to do, however, he generally prefers the instruments, as so much pounding on the back of the finger used as a pleximeter is apt to make it sore. Besides, the instruments bring out the sounds more distinctly, especially for purposes of demonstration to others.

Unless the patient is really obliged to lie down, he should be percussed in the sitting or standing posture, with his arms placed as already described for auscultation, the examiner being directly in front. The two sides should be percussed at the same stage of respiration, as the expanded lung occupies more room, pushing down the liver and spleen and pressing more in front of the heart; the difference between a full inspiration and a deep expiration being very considerable.

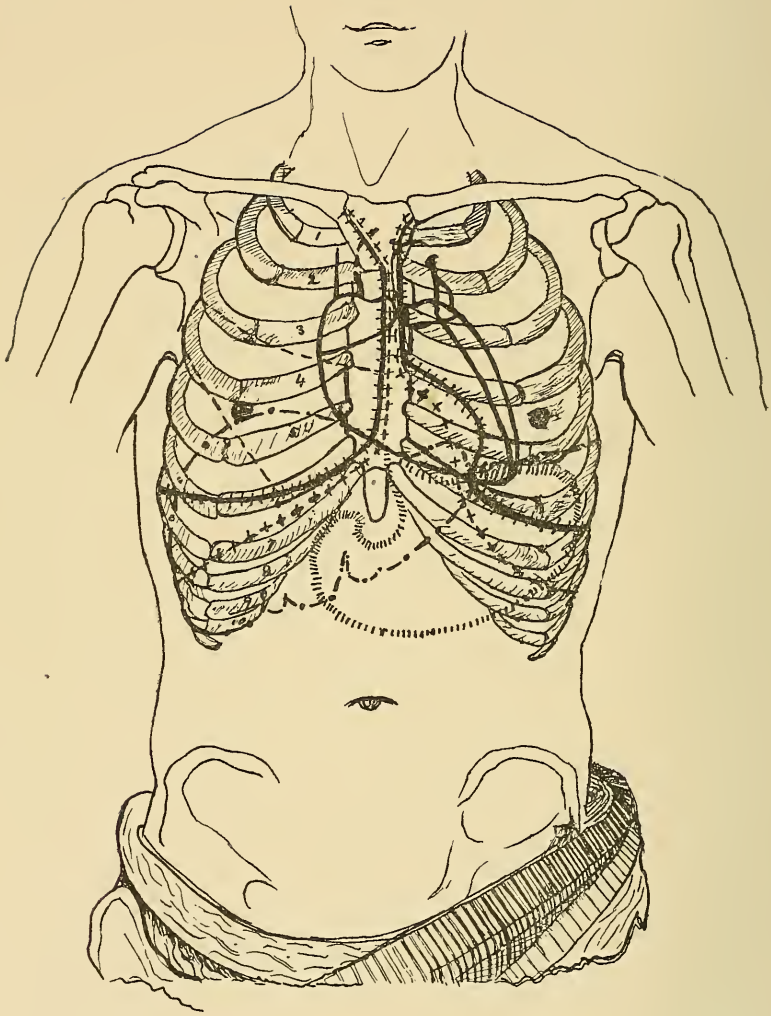
Since we draw our inferences as to the condition of the lungs from the comparative sound in different parts of the chest rather than from the absolute sound, this varying somewhat in different individuals, it is important to strike, immediately after each other and with the same force, portions on one side which correspond as nearly as possible to portions on the other side. Four or five raps in succession are best, and should be quick and sharp rather than slow and heavy. More forcible blows are required to

elicit the sounds of deeply seated than of superficial portions. The finger or pleximeter should be applied firmly on the spot to be examined, and with precisely the same amount of firmness on the corresponding spot on the other side.

The pressure should be sufficient to condense the soft parts on the outside of the chest. Percussion should be performed by a movement of the wrist alone, the arm and forearm remaining motionless. It would be well for the beginner to commence by percussing the right infra-clavicular region in a healthy subject, and to contrast the vesicular resonance found here with the flatness of the liver. Next he might try to bring out the proper sound of that part of the liver which lies underneath the lung. After becoming practically familiar with all the sounds in the different regions in health, he can try, as a final test of his powers, the deep cardiac space. If he can bring out the sounds of that satisfactorily, he may consider himself proficient.

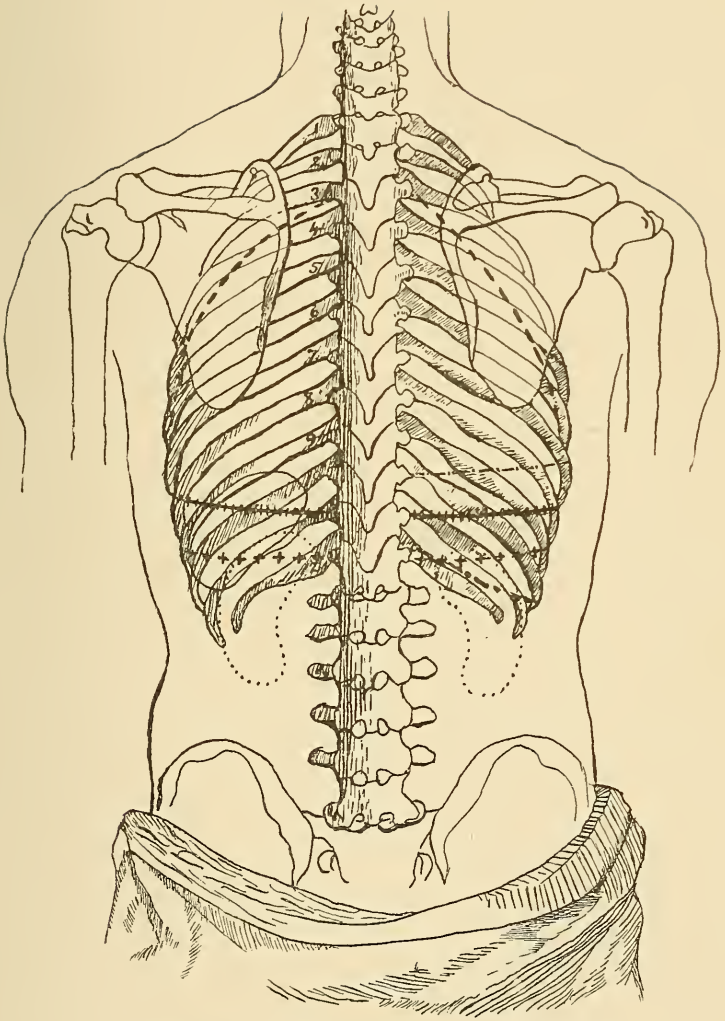
Heart-sounds. — In health there is no difficulty in telling by auscultation which is the first and which the second sound of the heart by the rhythm and the distinctive characters of the two sounds at the apex and base ; and generally it is easy to decide the question in the same way if the heart is diseased, when it is desired to know whether a murmur is systolic, presystolic, or diastolic. But sometimes it is impossible or difficult to do so. In such cases, if the apex-beat can be felt, this being synchronous with the first sound, the problem is at once solved. If it cannot be felt, the radial pulse will settle the point, or still better the carotid, which is more nearly synchronous with the first sound of the heart.

Plate I.



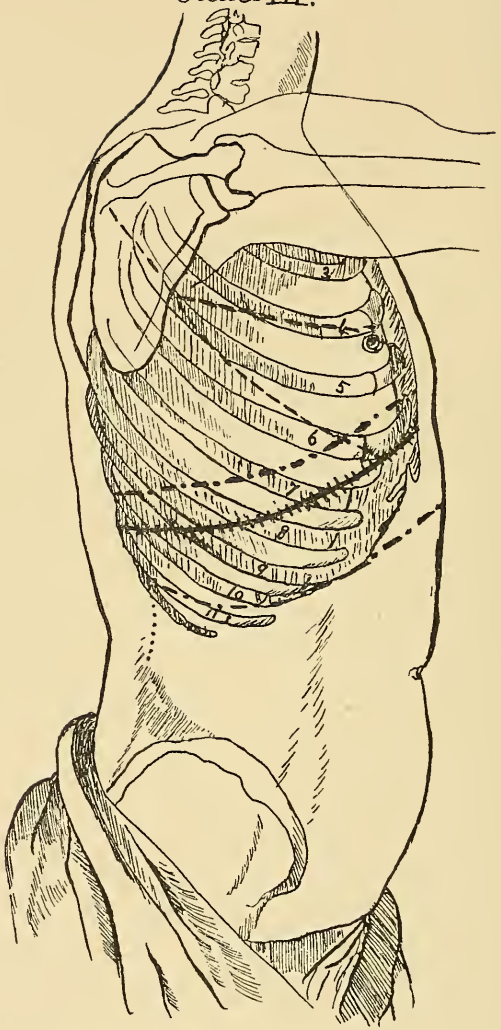
Heart— Lungs ++++ Interlobar fissures - - - -
Pleural cavities + + + Stomach ,,,,,, Liver -.-.-.

Plate II.



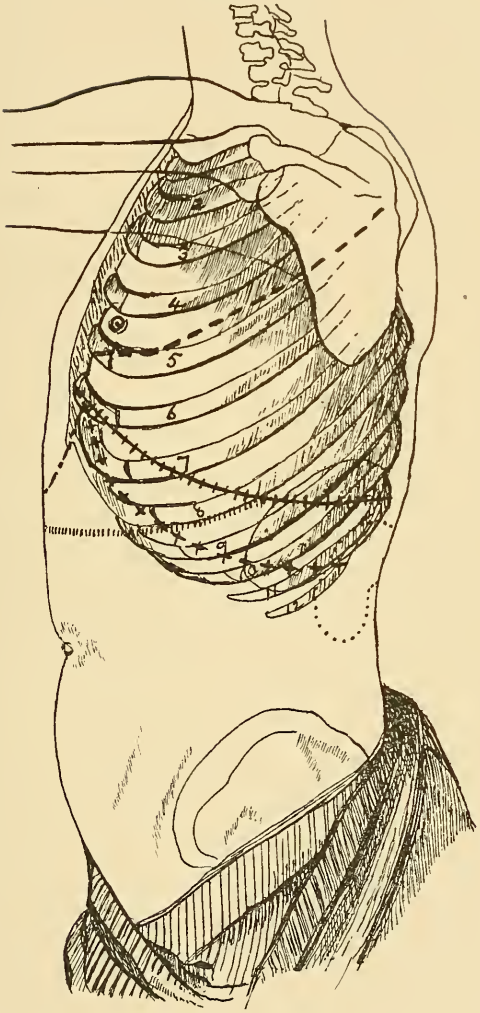
Lungs ~~~ Interlobar fissures --- liver -.-.-.
Kidneys ..... Pleural cavities +++ Spleen —

Plate III.



Lung ++++ Interlobar fissures - - - liver -.-.-. kidney.....

Plate IV.



Lung ~~~ Interlobar fissure - - - liver -.-.-.

Pleural cavity + + + stomach ||||| kidney ..... spleen —

PART I.

PHYSICAL SIGNS.

TABLE NO. 1.

VARIETIES.	CHARACTER OF THE SOUND.
VESICULAR RESPIRATION. (Pulmonary.)	*Inspiration.* A soft, diffused sound of a *breezy* character, gradually developed and continuous. Increased in intensity with the rapidity and force of respiration, and prolonged by a full inspiration. *Low pitch.* *Expiration.* Not vesicular, but *feebly blowing* in quality. Pitch lower and intensity much less than in inspiration. Usually not more than one fourth the length of inspiration, and absent in about one third of the cases. No interval between inspiration and expiration.
PUERILE RESPIRATION.	The same quality, pitch, and rhythm as the (pulmonary) vesicular murmur, but exaggerated or *intensified in degree.*
SENILE RESPIRATION.	The same as the vesicular respiration, except that the *intensity is diminished* and the expiration relatively more developed and longer.
TRACHEAL OR LARYNGEAL RESPIRATION.	*Inspiration.* *Tubular* in quality, loud, dry, and hollow. *High pitch.* An interval between inspiration and expiration. *Expiration.* Tubular in quality. Uniformly present. As long as the inspiratory sound, and generally longer. More intense and higher in pitch.

RESPIRATION IN HEALTH.

HOW PRODUCED.	USUAL SEAT.
Inspiratory Sound. 1. "By vibrations excited in the inward current of air by its friction against the walls of the air passages. 2. By the obstacles presented by the subdivision of the bronchi;" and 3. By the forcible separation of the walls of the pulmonary vesicles, which after the previous expiration have become more or less adherent on account of their natural moisture. *Expiratory Sound.* Simply "by the vibrations excited in the expired air by its friction against the walls of the air-passages."	All parts of the chest. There are variations in the intensity of the murmur in the different regions of the chest, there being more in the infra-clavicular and inter-scapular and in the axillary and infra-axillary regions than in the mammary and infra-mammary regions, and least of all in the scapular region. Sometimes there is also a slight disparity between the two sides, in which case the vesicular quality is more marked and the pitch lower on the left than on the right side, in the latter there being a slight approach to the character of broncho-vesicular respiration (Table No. 4), *i. e.*, expiration a little longer with higher pitch, and inspiration a little shortened.
The greater intensity of the murmur is owing to the greater freedom of the action of the lungs in early childhood.	In children, in all parts of the chest where the ordinary vesicular respiration is audible.
The change is owing to the attenuation of the walls of the air-cells in aged persons.	In old age, in all parts of the chest where the ordinary vesicular respiration is audible.
By the rush of air through a tube of considerable diameter, rough and irregular on its internal surface, and possessing sound-reflecting properties. "The higher pitch of the expiratory sound is due to the greater contraction of the glottis by the approximation of the vocal chords in expiration."	In the supra-sternal region, over the trachea and larynx.

TABLE NO. 2.—RESPIRATION IN DISEASE.

VARIETIES.	CHARACTER OF THE SOUND.	HOW PRODUCED.
EXAGGERATED RESPIRATION. (Puerile, supplementary, increased, hypervesicular.)	Like the healthy vesicular murmur in pitch, rhythm, and quality, but *intensified in degree.* Identical in character with the puerile respiration of healthy children.	By the excessive action of certain healthy portions of the lungs, set up to supply the deficiency of respiration in other portions, which are destroyed or affected by disease.
FEEBLE RESPIRATION. (Diminished, weak.)	"The ordinary vesicular murmur, not altered in character, but simply *diminished in intensity and duration.*"	By any cause which interferes with and prevents the full inflation of the lungs. Such as— 1. An obstruction to the passage of air in some portion of the air tubes. 2. An obstruction or over-distention of the air vesicles. 3. Some restraint on the movements of the chest. 4. The respiratory murmur may be imperfectly transmitted to the ear, owing to intervening fluids, solids, or air.
SUPPRESSED RESPIRATION. (Absent.)	No sound is heard.	By very great obstruction to the entrance of air, or by the interposition of fluid or air in the cavity of the pleura, preventing the transmission of the sound.

ABNORMAL INTENSITY.

USUAL SEAT.	DISEASES INDICATED.
Not peculiar to any portion of the chest, and not diffused generally throughout both sides of the chest, like the healthy puerile breathing, but limited to certain spots in the vicinity of diseased portions of the lungs, or heard *all over the healthy lung, when the other is diseased.* If heard all over both lungs, it is to be regarded merely as an individual peculiarity and not as a sign of disease.	Pleurisy. Pneumonia. Phthisis. Vesicular emphysema. Apoplectic effusion. Carcinoma. Spasmodic asthma. Pneumothorax. Foreign body in bronchus. Aneurismal or other intra-thoracic tumors pressing on certain bronchi.
Variable. The whole or a part of a lung. Feeble respiration, occurring in so many conditions, becomes of diagnostic importance only when associated with other phenomena.	1. Croup; œdema or spasm of the glottis; inflammatory exudations in the larynx; foreign body in a bronchus; mucus, serum, blood, or pus in bronchus; swelling of mucous membrane in bronchitis; asthma; permanent contraction of bronchi; tumors pressing on bronchi, *i. e.*, aneurism or enlarged lymphatic gland. 2. Phthisis, pneumonia, pulmonary œdema, vesicular emphysema, extravasation of blood. 3. Paralysis of costal muscles or of diaphragm; general debility; permanent contraction after chronic pleurisy; old pleuritic adhesions; deformity of chest; the pain of acute pleurisy, pneumonia, intercostal neuralgia, pleurodynia, or peritonitis; the mechanical interference of ascites, pregnancy, and abdominal tumors. 4. Pleuritic effusion, thick layer of lymph on pleura, hydrothorax, pneumo-hydrothorax, tumors, thick layer of fat on outside of chest.
"May occur in any portion of the chest, but always limited to one or more parts, and usually to the whole or some portion of one lung only."	Same diseases as feeble respiration, with this difference, that it indicates more decided anatomical lesions. Most commonly observed in connection with *excessive effusions of fluid or air in the pleura.*

TABLE NO. 3.—RESPIRATION IN DISEASE.

VARIETIES.	CHARACTER OF THE SOUND.	HOW PRODUCED.
JERKING RESPIRATION. (Interrupted, wavy, cogged-wheel.)	Both sounds, especially the inspiratory, instead of being even and continuous from their commencement to their close, are broken into one, two, or more parts.	1. By some local obstacle to the ingress or egress of air. Usually the pressure of tubercular or other deposit, or the presence of thick mucus in the air passages, or spasm of a tube. 2. By nervousness or shrinking on account of pain.
PROLONGED EXPIRATION.	The rhythm changed so that the expiration is lengthened absolutely and relatively to the inspiration, which is generally shortened.	1. When the air-cells are over-distended and have lost their natural elasticity from this distention or (2) on account of deposits in their walls, the air has difficulty in making its escape. This difficulty may be increased in the latter case by the prominences produced by the deposit on the interior of the final bronchial ramifications, these prominences opposing obstacles to the rapid egress of air.

ABNORMAL RHYTHM.

USUAL SEAT.	DISEASES INDICATED.
1. Limited to a part of the chest, usually one of the apices, where it is of more clinical significance than when 2. Generally diffused over the chest.	1. Incipient phthisis. Circumscribed bronchitis. Asthma. 2. Nervousness. Pleurisy. Pleurodynia. Intercostal neuralgia. This sound is occasionally observed even in healthy persons.
1. All over one or both sides of the chest, especially the upper parts. 2. In the infra-clavicular region, especially on the left side.	1. Emphysema (if non-tubular and of low pitch). 2. Phthisis (if tubular and of high pitch). Occasionally heard to a slight extent on the right side of the healthy chest.

TABLE NO. 4. — RESPIRATION IN DISEASE.

VARIETIES.	CHARACTER OF THE SOUND.	HOW PRODUCED.
BRONCHIAL RESPIRATION. (Tubular.)	*Inspiration.* Quality *tubular*, non-vesicular. Intensity variable, pitch high. Inspiratory sound shortened; ends before end of inspiratory act. Rarely absent. Can be imitated by blowing through a tube formed by the fingers and palm of one hand. *Expiration.* Quality tubular. *Prolonged;* as long as or longer than the sound of inspiration and more intense. Pitch still higher. Rarely absent.	It always denotes considerable or complete *solidification* of pulmonary substance, either by the addition of some morbid material or by compression. This involves suppression of the vesicular murmur. The sound produced by the passage of air through the bronchi, which in health is stifled by the vesicular murmur and rendered inaudible, is *now* transmitted to the ear intensified by the solidified lung, which is a better sound-conductor than the healthy lung.
BRONCHO-VESICULAR RESPIRATION. (Rude, rough, harsh, vesiculo-bronchial, tubulo-vesicular.)	*Inspiration.* The tubular and vesicular quality combined in varied proportions, and the pitch raised in proportion to the amount of tubular quality. Duration frequently shortened at the end. Intensity variable. Sometimes absent. *Expiration.* *Prolonged.* Generally more intense than inspiration. Pitch higher than in inspiration. Quality according to quality in inspiration. Sometimes absent.	Being a combination, in varied proportions, of the bronchial and vesicular respiration, it is produced by the same cause as the preceding, although not to the same extent; the amount of solidification not being sufficient to extinguish *all* vesicular murmur.

ABNORMAL QUALITY AND PITCH.

USUAL SEAT.	DISEASES INDICATED.
In phthisis and pleurisy generally in the upper part of the chest. In pneumonia generally the lower part behind, especially on the right side. In other cases variable. Being identical with the healthy "Tracheal Respiration," it may be studied in the supra-sternal region of a sound person.	Pneumonia. Phthisis. Pleuritic effusion. Collapse of pulmonary lobules. Pulmonary œdema. Pulmonary apoplexy. Carcinoma. Hydrothorax. Hydro-pericardium. Aneurism and other tumors.
Same as the preceding. A very important sign in the diagnosis of *incipient phthisis.*	Same diseases as the preceding, only indicating a *lesser amount of solidification.* In the resolution of acute lobar pneumonia (croupous), all varieties of the sound may be heard by daily auscultation, from that which verges on the bronchial in complete solidification, to that which verges on the vesicular, which comes with recovery.

TABLE NO. 4, *Continued.* — RESPIRATION IN DISEASE.

VARIETIES.	CHARACTER OF THE SOUND.	HOW PRODUCED.
CAVERNOUS RESPIRATION.	*Inspiration.* Quality *blowing* simply; non-vesicular, non-tubular. Often mixed with gurgling. (Table No. 5.) *Expiration.* Quality blowing. Lower pitch than inspiration. May be absent. Often mixed with gurgling. Some recognize also a broncho-cavernous respiration, which, as its name signifies, is a combination in varied proportions of this and the bronchial respiration.	Produced by the passage of air into and from a cavity with *flaccid walls*. Absent when the cavity is filled with liquid, or when the tubes leading to it are obstructed. If deep-seated, and beneath solidified lung, it may be drowned out by the loud bronchial respiration. Râles also may obscure it. It can be imitated by blowing into a cavity formed by the two hands.
AMPHORIC RESPIRATION.	A kind of musical intonation like the sound produced by blowing upon the open mouth of a decanter or phial. It may accompany either inspiration or expiration or both. It may be humming and of low pitch or decidedly ringing and metallic.	Not caused, like cavernous respiration, "by the *free circulation* of air within a cavity, but by the current of air in the bronchial tubes *acting upon* the air contained within a cavity." The cavity must have more or less *rigid walls*, which do not collapse with expiration; it must be of considerable size, partially or entirely free from liquid contents; there must be an unobstructed communication (or merely a very thin septum) between a bronchial tube and the cavity, and the perforation must be above the level of the liquid, if there be any liquid.

ABNORMAL QUALITY AND PITCH, *Continued.*

USUAL SEAT.	DISEASES INDICATED.
Heard over a circumscribed area, corresponding to the size of the cavity. Being vastly more common in phthisis than in other diseases, its seat is generally at the summit of the chest.	Phthisis. Rarely in Pulmonary abscess. Gangrene. Cancer. Bronchial dilatation.
Generally confined to a circumscribed space, but is sometimes diffused more or less over the chest.	Almost pathognomonic of pneumo-hydrothorax with pulmonary fistula. Sometimes in phthisis. Still more rarely in abscess, etc.

TABLE NO. 5.

VARIETIES.	CHARACTER OF THE SOUND.	RELATION TO INSPIRATION AND EXPIRATION.
I. TRACHEAL AND LARYNGEAL RÂLES. *a. Dry or vibrating.*	Whistling, wheezing, crowing, whooping, etc. Most of them are heard without special auscultation and at a distance.	Mostly with inspiration. Sometimes with both.
b. Moist or bubbling.	Bubbling sounds, often called "death-rattles."	With both.
II. Bronchial Râles. *a. Dry or vibrating.* (1.) SONOROUS RÂLES.	*Low-pitched, musical sounds,* compared to snoring, cooing, buzzing, grunting, humming, a note of a bass-viol, etc.	With both or either, especially with expiration.
(2.) SIBILANT RÂLES.	*High-pitched,* whistling, hissing, or clicking sounds of variable intensity and duration and irregular recurrence. Often compared to *shrill musical tones,* the cries of young animals, the chirping of birds, whistling of wind through a keyhole, etc. Heard with the respiratory murmur, or the latter may be masked. Loudest in asthma.	With both or either, especially with inspiration.

RÂLES (Rhonchi).

HOW PRODUCED.	USUAL SEAT.	DISEASES INDICATED.
1. By contraction at the glottis from spasm, œdema, exudation of lymph, etc. 2. By diminution of calibre of tube below the glottis.	Larynx and trachea. These sounds are often propagated through the bronchial tubes and heard in the chest, where they may, in a few cases, be thought to originate. Auscultation of the larynx and trachea will at once settle the point.	1. Laryngismus stridulus. Pertussis. Croup. 2. Pressure of a tumor. Morbid growths or deposits. Cicatrization of ulcers. Paralysis of laryngeal muscles.
By the passage of air through mucus or other liquid in the tube.	Larynx and trachea.	The moribund state. Coma. Inability to expectorate.
"By the vibrations excited by the passage of air through the *larger bronchi*, irregularly narrowed, either by spasmodic contraction of their circular fibres," or by swelling of their mucous membrane, or by the adhesion of viscid mucus to their walls, or by the pressure of a tumor.	Constantly liable to change position. May sometimes disappear after coughing. They are either — 1. More or less diffused over the whole chest; or, 2. Confined to one side of the chest, or limited to a circumscribed space. (In phthisis the circumscribed space is generally at the summit of the chest.)	1. Asthma. Bronchitis. 2. Circumscribed bronchitis occurring with pneumonia or phthisis.
Produced in the same manner, but in the *smaller bronchial tubes*.	Same as sonorous râles, with which they are frequently mingled.	Same diseases as the sonorous râles, and indicating that the smaller tubes are affected.

TABLE NO. 5, *Continued.*

VARIETIES.	CHARACTER OF THE SOUND.	RELATION TO INSPIRATION AND EXPIRATION.
b. Moist or bubbling. (1.) COARSE BUBBLING RÂLES. (Coarse mucous râles.)	A coarse bubbling sound, conveying the impression of the bursting of bubbles of somewhat large size. The "death-rattles" are an exaggerated type of them. If any solidification of the lung exists around the tubes in which the sound is produced, the pitch is raised in proportion to the amount.	With either or both.
(2.) FINE BUBBLING RÂLES. (Fine mucous râles.)	The same quality of sound, but the bubbles are smaller. The coarse and fine bubbling râles may be imitated by blowing into a tumbler of water through different sized tubes.	With either or both.
(3.) SUBCREPITANT RÂLES.	The same quality, but the bubbles are very small indeed. Still, they are somewhat unequal in size, as in the other moist râles. Slowly evolved.	With either or both. When with inspiration, near the beginning.

RÂLES, *Continued.*

HOW PRODUCED.	USUAL SEAT.	DISEASES INDICATED.
By the bubbling of air through liquid (mucus, pus, softened tubercle, blood, or serum), in the *larger bronchial tubes.* Bubbling râles, both coarse and fine, are very often called *mucous râles.* This term is not so appropriate, as the liquid by means of which they are produced is not always mucus. Unless specified, when "bubbling râles" are mentioned, bronchial and not tracheal are understood.	Constantly liable to change position, especially after expectoration or coughing, and not occurring with every respiration. They are either — 1. More or less diffused over the whole chest, especially the infra-scapular regions, or 2. Confined to one side of the chest, or limited to a circumscribed space. (In phthisis the circumscribed space is generally the summit of the chest.)	1. Bronchitis. 2. Circumscribed bronchitis, occurring with phthisis or pneumonia. Softened tubercle, etc., in tubes in phthisis, blood in hæmoptysis or pulmonary apoplexy, serum in œdema, pus in pulmonary or hepatic abscess.
Produced in the same manner in the *smaller bronchial tubes.*	Same as coarse bubbling râles, with which they are frequently mingled.	Same as coarse bubbling râles, but smaller tubes affected.
Produced in the same manner in the *very minute bronchial ramifications.*	Same as coarse bubbling râles, excepting that they are very much less liable to change position.	1. Capillary bronchitis. Pulmonary œdema. 2. Lobar pneumonia during resolution. Incipient phthisis.

TABLE NO. 5, *Continued.*

VARIETIES.	CHARACTER OF THE SOUND.	RELATION TO INSPIRATION AND EXPIRATION.
III. Vesicular Râles. CREPITANT RÂLES.	Fine, *dry*, crepitating or *crackling sounds*, compared to those produced by fine salt on a fire, or by rubbing a lock of hair between the thumb and finger close to the ear. They resemble the subcrepitant, from which they must be distinguished. The crepitations are *equal in size, dry*, not bubbling, *constant*, not variable, *rapidly evolved*, not suspended by coughing and expectoration, and occur only with *inspiration.*	With *inspiration exclusively*, and near the end of it, especially in forced inspiration.
IV. Cavernous Râles. GURGLING RÂLES.	A hollow, gurgling sound, often very intense, sometimes metallic or amphoric, usually of low pitch, conveying the impression of *very large bubbles bursting in a large space*, the loudness of the gurgling being proportionate to the size of the cavity. When this is small, hardly distinguishable from coarse bubbling bronchial râles.	With either or both. Oftener with inspiration than expiration.

RÂLES, *Continued.*

HOW PRODUCED.	USUAL SEAT.	DISEASES INDICATED.
Produced, according to the most rational theory (Dr. Carr's), by the abrupt separation, during inspiration, of the walls of the *air-vesicles*, which had, after the preceding expiration, become adherent by means of the viscid exudation incident to the early stage of inflammation. This mode of its production can be illustrated by moistening the thumb and finger with a little paste or solution of gum arabic, and alternately pressing them together and separating them near the ear.	Most commonly over the lower part of the chest behind, on one side, oftener the right. Often associated with the subcrepitant râles in the resolution of pneumonia.	Almost pathognomonic of *pneumonia.* If heard only over a circumscribed space at the summit of the chest, *phthisis* is generally indicated. Even in such cases the crepitant râle is indicative of a circumscribed pneumonic process.
Produced by the bursting of large bubbles and the agitation of a mass of liquid in a cavity of considerable size. When the cavity is empty, cavernous respiration takes the place of the cavernous râles. The two signs may thus confirm each other. Not produced if the cavity is full. The communication with the bronchial tubes must be unobstructed and below the level of the liquid. Therefore gurgling is not heard in every case of a cavity.	A circumscribed space, in forty-nine out of fifty cases at the summit of the chest.	Phthisis. Cavity from abscess, circumscribed gangrene, cancer, etc.

TABLE NO. 6.

VARIETIES.	CHARACTER OF THE SOUND.	RELATION TO INSPIRATION AND EXPIRATION.
FRICTION SOUNDS.	Grazing, rubbing, creaking like new leather, grating, crumpling, rasping, the harshness varying according to the roughness of the surface of the pleura. The grazing and rubbing sounds, which are the most common, may be imitated by placing over the ear the palm of one hand and moving over its dorsal surface slowly the pulpy portion of a finger of the other hand. Intensity very variable, sometimes heard even by the patient. The sound is dry and appears to be near the ear, not continuous generally, but jerking, rhythmical with respiration. Transient or lasting. Occasionally attended with fremitus.	With both or with inspiration alone. Very rarely with expiration alone.
METALLIC TINKLING.	A high-pitched, abrupt, short, *silvery tone*, like the tinkling of a small bell, dropping small shot into a brass basin, etc., consisting of a single sound, or more commonly of two, three, or more in quick succession. Accompanies respiration, speaking, and coughing, especially the two latter. Irregular in its appearance. Only liable to be confounded with a somewhat similar sound in the stomach.	With both or either; especially at the end of inspiration.

MORBID PLEURAL SOUNDS.

HOW PRODUCED.	USUAL SEAT.	DISEASES INDICATED.
By the rubbing together of two pleural surfaces (pulmonary with costal, and often diaphragmatic with costal) which have been roughened by lymph or other deposit.	In common pleurisy usually confined to a small space at the middle or lower part of the chest laterally or posteriorly; but may be more or less diffused, and occasionally is heard over the entire chest. In phthisis at the summit of the chest.	Pleurisy. Also in phthisis and pneumonia where there is accompanying secondary pleurisy.
There must be a *large* cavity, containing liquid and air or gas, and almost invariably there is communication with a bronchial tube. There are several different theories as to the production of this sound, and probably each one of the following (which have all been experimentally verified) may account for it either alone or in connection with the others. 1. Drops of fluid fall from the upper part of the space upon the surface of the liquid below, when the patient, previously lying down, sits or stands up. (Laennec.) 2. Air, working through a fistulous orifice opening below the level of the liquid, rises to the surface, forming bubbles which break and produce the sound. (Spittel.) 3. Simple agitation of the liquid may give rise to the sound, as in succussion, coughing, etc. 4. Bubbles of mucus bursting at the opening of a fistulous orifice situated above the level of the liquid.	Generally at the middle third of the chest, in front, behind, or at the side. Sometimes diffused over the entire chest on one side. Sometimes a circumscribed space at the summit.	Almost pathognomonic of pneumo-hydrothorax. Very rarely in phthisical cavities.

TABLE NO. 6, *Continued.*

VARIETIES.	CHARACTER OF THE SOUND.	RELATION TO INSPIRATION AND EXPIRATION.
SPLASHING. (Hippocratic succussion sound.)	Such a noise as is produced by shaking a bottle partly filled with liquid. Only liable to be confounded with a somewhat similar sound in the stomach. Often it has a high-pitched amphoric tone, and may be mingled with metallic tinkling. Sometimes loud enough to be heard at a distance.	

MORBID PLEURAL SOUNDS, *Continued.*

HOW PRODUCED.	USUAL SEAT.	DISEASES INDICATED.
Produced by jerking the body of the patient with an abrupt forcible movement, the ear being in contact with or in close proximity to the chest. Sometimes produced unintentionally by the patient himself, by quick motions, such as horseback exercise, jumping, etc. The liquid must not be too abundant nor too thick, and there must also be air in the cavity.	Generally over the whole of the affected side, unless there are adhesions. Very rarely at the summit of the chest.	Pathognomonic of pneumo-hydrothorax. Very rarely in tubercular and other cavities in the lung.

TABLE NO. 7.

VARIETIES.	CHARACTER OF THE SOUND.
TRACHEAL VOICE. (Tracheophony, laryngeal voice, laryngophony.)	A strong *resonance*, with a powerful sensation of concussion or *shock*, and also with a strong sense of vibration or thrill called *fremitus*, which can be appreciated by the ear as well as by palpation. The voice is *concentrated* and *near the ear*, seeming to pass right through the stethoscope. Sometimes the articulated words are transmitted so as to be heard as distinctly as when coming direct from the lips. When this occurs over the chest as a result of disease, it is called perfect *pectoriloquy*. Oftener, however, the transmission of speech from the trachea furnishes a type of imperfect pectoriloquy. All these phenomena may differ in intensity. The variations in the first three, however, — resonance, shock, and fremitus, — do not always correspond with the variations in the distinctness with which speech is transmitted.
TRACHEAL WHISPER. (Whispering tracheophony.)	There is little or no shock or fremitus. Whispered words are transmitted more or less perfectly, more so generally than loud words ; this feature corresponding to the morbid sign called whispering pectoriloquy.
NORMAL THORACIC VOCAL RESONANCE.	The resonance is much weaker than in tracheophony, and is quite variable in intensity. Often over portions of the chest none is appreciable, and in some persons it is absent over the entire chest. The sound is *diffused* and seems *farther removed* from the ear, rarely accompanied with shock, and not always with fremitus. The sound often amounts to little more than a humming or buzzing. No pectoriloquy.
NORMAL BRONCHIAL WHISPER.	The characters of the sounds produced by the whispered voice are identical with those produced by the act of expiration, in all respects except that the sounds are more intense, generally, than those even of a forced expiration. The intensity is variable, as in the preceding. There is the same difference between this and the tracheal whisper with regard to diffusion, concentration, and nearness to the ear that there is between the normal thoracic vocal resonance and the tracheal voice.

THE VOICE IN HEALTH.

HOW PRODUCED.	USUAL SEAT.
The resonance by the reverberation of the voice in the sound-reflecting tube, the shock by the sudden arrest of the column of expired air by the act of speaking, the fremitus by the vibrations of the tracheal tube in connection with those of the vocal chords, and the distinct transmission of speech by the concentrating and sound-reflecting properties of the hollow tube.	Trachea and larynx. Apply the stethoscope over the broad surface of the thyroid cartilage or just above the sternal notch. To bring out the vocal phenomena to the best advantage, both here and over the chest in health and in disease, the patient should be instructed to count slowly one, two, three, one, two, three, etc., at first with the loud voice and afterwards in a whisper.
The sound corresponds to the sound of expiration in tracheal or laryngeal respiration, and is in fact identical with it.	Trachea and larynx.
The vibrations are weakened and diffused by passing through the subdivisions of the bronchi and the spongy tissue of the lung before reaching the surface of the chest.	There are considerable variations in this sound in the different regions of the chest, it being more intense in the infra-clavicular and inter-scapular regions than in the axillary and infra-axillary ; and in the latter more than in the mammary and infra-mammary. There is the least resonance in the scapular region. There is also often a slight difference in the two sides comparatively. When there is any difference, the right side is the more resonant. This last remark applies also to fremitus. The amount of the fremitus, however, is not necessarily proportionate to that of the resonance.
The conduction of sound by the whispered voice is chiefly by the air contained in the bronchial tubes.	About the same variations are observed as in the preceding.

TABLE NO. 8.

VARIETIES.	CHARACTER OF THE SOUND.
Diminished and Suppressed Vocal Resonance and Fremitus.	Simply less in intensity than normal, or absent altogether. There being no standard of intensity, comparison must be made between the two sides, allowing, of course, for the slight possible difference in health. (Table No. 7.) The fremitus generally, but not always, lessened in the same proportion as the resonance.
Increased Vocal Resonance and Fremitus.	Merely an increase in *intensity*, without change in other respects. Generally associated with the broncho-vesicular respiration.
Increased Bronchial Whisper.	Same as the expiratory sound in broncho-vesicular respiration, namely, increase of intensity and length, more or less tubular in quality, and higher in pitch than the whisper in health, these alterations being proportionate to the degree of solidification.
Bronchophony.	Vocal sound *concentrated* and *near the ear.* Pitch higher than normal. Intensity and fremitus variable; may be greater or less than in health.
Whispering Bronchophony.	Same as the expiratory sound in the bronchial respiration, namely, intensified, long, high pitched, and tubular.

THE VOICE IN DISEASE.

HOW PRODUCED.	USUAL SEAT.	DISEASES INDICATED.
By the removal of the lungs from the thoracic walls, or by anything that prevents the circulation of the column of air in the tubes which propagate the sound.	When the pleural cavity is partially filled with fluid, the vocal resonance and fremitus are diminished or suppressed below the level of the liquid, but increased generally just above the level, owing to the condensation.	Pleuritic effusion, empyema, hydrothorax, pneumo - hydrothorax, obstruction of bronchial tubes by mucus or by the pressure of aneurismal or other tumors. Exceptional in solidification, but sometimes observed in complete solidification of pneumonia, abscess full of pus, cavity filled with liquid, pulmonary œdema.
By *slight consolidation* of the lung tissue around the air tubes, whereby the sound-reflecting power of the tubes is increased, and the pulmonary parenchyma is rendered more homogeneous and a better sound-conductor.	Not confined to any part of the chest, but usually most marked and of the greatest significance towards the apices of the lungs in phthisis.	Phthisis. Pneumonia. Compressed lung in moderate pleuritic effusion and collapse of pulmonary lobules. Carcinoma, hæmorrhagic infarctus. Sometimes over cavities.
Same as the preceding.	Same as the preceding.	Same as the preceding.
Same as the preceding, except that the *solidification is greater*, and sometimes *complete*. Less solidification is required than for the production of bronchial respiration. Therefore bronchophony may be associated with a broncho-vesicular respiration as well as with bronchial.	In pneumonia generally the middle and lower thirds behind. Of great importance as suggestive of phthisis when existing at the apex of the lung. In pleuritic effusion, over condensed lung at summit of chest.	Pneumonia. Phthisis. Lung condensed by effusion in pleurisy or pneumo-hydrothorax, or by pressure of a tumor, collapse of pulmonary lobules, cancer, or bronchial dilatation, the tubes being surrounded by condensed and indurated lung.
Same as the preceding.	Same as the preceding.	Same as the preceding.

TABLE NO. 8, *Continued.*

VARIETIES.	CHARACTER OF THE SOUND.
CAVERNOUS WHISPER.	Same as the expiratory sound in the cavernous respiration, namely: low pitch and blowing (non-tubular) quality, with variable intensity.
AMPHORIC VOICE AND WHISPER.	A ringing sound of a metallic quality, not distinctly articulated, not transmitted forcibly through the stethoscope, but resembling the sound produced by speaking into an empty jar. The amphoric quality may accompany the loud voice or *whisper,* more especially the latter, the resonance and fremitus of the loud voice obscuring somewhat the musical intonation.
PECTORILOQUY AND WHISPERING PECTORILOQUY.	*Articulated words are transmitted* directly through the stethoscope into the ear. This is more frequent with the whispered than with the loud voice. Care must be taken not to confuse the words coming directly from the patient's mouth with the transmission of them through the chest. Unless a double stethoscope is used, one ear must be closed. This is a rare sign, but the type of it can be studied in health in connection with tracheal voice.
ÆGOPHONY.	A tremulous, bleating or quavering sound, *like the cry of a goat,* from which the term is derived, and often compared to the "Punch and Judy" voice. Synchronous with, but of a higher pitch than, the voice of the patient, or else following it like a feebly whispered echo, and rarely traversing the stethoscope.
METALLIC TINKLING.	Has the same characters when heard in connection with the loud or whispered voice as with respiration (which see), but is more intense.

THE VOICE IN DISEASE, *Continued.*

HOW PRODUCED.	USUAL SEAT.	DISEASES INDICATED.
Produced by the air passing out of an empty, superficial cavity with *flaccid walls.*	A circumscribed space, generally at summit of chest, — Or in other parts.	Phthisis. Purulent, gangrenous, or cancerous excavation.
By the reverberation of the voice, causing an echo, in a large cavity with *rigid walls,* and subject to the same conditions as in the production of amphoric respiration (which see).	Same as amphoric respiration.	Same as amphoric respiration.
"Sometimes by the *condensation* of lung tissue around a large bronchus, whereby the transmission of the sound to the ear is facilitated. More generally by the formation of *cavities* possessing smooth, sound-reflecting walls."	"Not confined to any portion of the lungs, but occurring most commonly at the apices and in the upper lobes."	Chiefly Phthisis. Sometimes pneumonia, pouchlike dilatation of bronchi, circumscribed gangrene, and abscess.
By the vibrations consequent on the existence of a thin stratum of liquid in the pleural cavity. Not apt to occur when the chest is more than half full of liquid. The lung must be more or less condensed at the level of the liquid. This accounts for the elevation of pitch. When there becomes too much liquid, the ægophony stops. Therefore in acute pleurisy it rarely continues longer than two or three days, sometimes only for a few hours.	Not confined to any portion of the chest, but most common at or near the inferior angle of the scapula; from here often extending to the inter-scapular space, and, in a zone from one to three fingers broad, following the line of the ribs towards the nipple (the patient sitting). This line indicates not the level of the liquid, but the points where it has the requisite degree of thinness to produce ægophony.	Pleuritic effusion. Pleuro-pneumonia. Hydrothorax. Empyema.
As in Table No. 6.	As in Table No. 6.	Mostly Pneumo-hydrothorax.

TABLE NO. 9.

VARIETIES.	CHARACTER OF THE SOUND.	HOW PRODUCED.
NORMAL VESICULAR RESONANCE. (Pulmonary.)	A full, clear, prolonged sound, of low pitch, its quality *sui generis*, only to be appreciated by actually hearing it, and its intensity varying with the force of the blow, the elasticity of the chest walls, the thickness of the layer of muscles and fat covering them, and the degree of inflation of the lungs.	By the vibration of the air in the uniform, elastic, spongy tissue of the lung when percussed.
FLATNESS. (Absence of resonance.)	The sound is *completely deadened*, and resembles that produced by percussing the thigh or shoulder. The finger used as a plexímeter experiences a greater sense of resistance than normal, especially in early life, before the costal cartilages have ceased to be elastic.	The absence of resonance is occasioned by serum or pus in the pleural sac, serum in the air-vesicles, complete solidification of lung tissue, tumors, etc.
DULLNESS. (Diminished resonance.)	Intermediate between the two preceding, the vesicular resonance being not lost but only *partially deadened*. The *degree* of dullness varies indefinitely. The pitch is higher than normal. The sense of resistance is increased in proportion to the degree of dullness.	By the same causes as the preceding, though existing to a lesser extent. The relative proportion of solids or liquids to air in the lungs is morbidly increased.

PERCUSSION SIGNS.

WHERE OBSERVED IN HEALTH.	DISEASES INDICATED.
Most strongly marked in the infra-clavicular regions. In the scapular and interscapular regions, on account of the layers of bone and muscles, the resonance is diminished, as it is also where the lung overlaps the heart and liver. In different regions the resonance varies so much that what would be normal for one would be decidedly abnormal for another. Each must be carefully studied by itself. The *area* of healthy resonance is of course *greater* with a full inflation of the lungs than in tranquil breathing, and *less* with a forced expiration. In some persons the resonance is *slightly* diminished on the *right* side in the infra-clavicular region in health, but never on the left side.	
Over the liver below the line of hepatic flatness. The lower border of the right lung marks the *line of hepatic flatness*, and the upper border of the underlying liver the *line of hepatic dullness*.	Pneumonia. Pleuritic effusion. Empyema. Hydrothorax. Phthisis, pulmonary œdema, condensation of lung from compression or from pulmonary collapse, cancer, aneurism, etc.
Over the heart and spleen; in the places where the lungs overlap the liver or heart; over the mammary gland in females; over thick layers of muscles on the ribs, especially behind; and all over the chest in very fat persons. In some persons there is in health a *slight* degree of dullness at the summit of the chest on the right side.	The same diseases as the above, where the same physical conditions exist to a less extent. In many of them dullness is more common than flatness. The deposit of phthisis is very rarely sufficient to give rise to more than dullness, and miliary tubercles, unless in great quantities, may not even give rise to dullness. Congestion of the lung may give rise to dullness, but never to flatness. Rarely we find dullness in emphysema, owing probably to increased tension of lungs and walls of chest. There may be slight dullness from exudation of lymph on pleura.

TABLE NO. 9, *Continued.*

VARIETIES.	CHARACTER OF THE SOUND.	HOW PRODUCED.
TYMPANITIC RESONANCE.	A *drum-like* sound, as its name signifies; the term often used to denote any resonance which is not vesicular. It is of variable intensity, either greater or less than the vesicular, of higher pitch, and accompanied with a sense of less resistance to the finger.	It requires for its production a large space filled with air, and bounded by *moderately tense*, elastic walls, capable of reflecting sonorous vibrations. If, however, the tension is *extreme*, the contained air does not vibrate, the tympanitic quality is lessened or destroyed, and the sound may become quite dull. When a common drum is made *extremely* tight and there is no escape for the air, the same dull effect is produced on being struck. Tympanitic resonance occurs under the following conditions: — 1. From air or gas in the pleural cavity. (Here the resonance is more intense than the normal vesicular.) 2. From air in pulmonary cavities. 3. Singularly enough, and contrary to what might be expected, tympanitic resonance is often heard over *partially solidified* lung (giving place to dullness when the solidification becomes complete). Where the upper lobe is thus resonant, as in phthisis before cavities have formed, and in pneumonia, it is generally explained by saying that the resonance must come from the air in the lower part of the trachea and the primary bronchi, being better conducted by solidified than by healthy lung; and where the lower lobe is solidified, that the tympanitic resonance, if present, is conducted in a similar way from the stomach or colon. Fuller, however, thinks it comes from the presence of air pent up in lung tissue in the immediate vicinity of consolidated tissue. Skoda and others explain it by diminution of tension.

PERCUSSION SIGNS, *Continued.*

WHERE OBSERVED IN HEALTH.	DISEASES INDICATED.
Heard over the stomach and bowels.	Pneumothorax. Pneumo-hydrothorax. Phthisis. Cavities after abscess, etc. Dilatation of bronchi. Pneumonia.

TABLE NO. 9, *Continued.*

VARIETIES.	CHARACTER OF THE SOUND.	HOW PRODUCED.
EXAGGERATED RESONANCE. (Vesiculo-tympanitic.)	Intermediate between the normal vesicular and the tympanitic resonance, and partaking of the characters of each. The pitch high in proportion as the tympanitic quality predominates. Intensity greater than normal.	1. By abnormal dilatation of the air cells. 2. If the effusion in pleurisy rises much above the middle of the chest, the pressure condenses the lung above the liquid, and dullness ensues. With a less amount of liquid, however, the resonance is generally exaggerated. Also, where pneumonia solidifies one lobe, the resonance over the other is generally exaggerated. Probably both cases are explained by assuming a condition approximating to emphysema in the lobe above the liquid in pleurisy, and in the healthy lobe in pneumonia, they expanding proportionally to the expansion caused by the diseased condition in the affected part.
AMPHORIC RESONANCE.	A kind of musical intonation, like the sound obtained by percussing an empty jar (amphora). It may be imitated by closing the mouth, inflating the cheeks, but not too tensely, and then filliping them with the finger.	The cavity must contain air, must have somewhat rigid walls, must be superficial or else covered by solidified lung, and there must be free communication with the bronchial tubes. The sound can be heard better if the ear or stethoscope is brought close to the patient's open mouth. Use slow and heavy percussion.
CRACKED-METAL RESONANCE. (Bruit du pôt fêlé.)	Like the sound produced by striking a cracked earthenware or metal jar or other vessel. Can be imitated by the school-boy trick of folding the hands so as to form a hollow, and striking the back of one of them on the knee. A loud, short, hollow, metallic sound, accompanied with hissing.	Produced exactly as in the school-boy trick referred to, by the sudden expulsion of air, and its forcible contact with the sides of the passage through which it is driven. The same conditions are necessary to its production as in amphoric resonance.

PERCUSSION SIGNS, *Continued.*

WHERE OBSERVED IN HEALTH.	DISEASES INDICATED.
	Emphysema (vesicular or interlobular or secondary to phthisical deposit, etc.). Pleurisy with effusion. Pneumonia.
Occasionally produced in children over a primary bronchus, owing to the yielding of the costal cartilages.	Mostly phthisical cavities, sometimes pneumo-hydrothorax. Occasionally at the summit of the chest in pleurisy with effusion.
As in the preceding. It may be produced unintentionally by the imperfect application of the finger or pleximeter to the chest walls, and the expulsion of air from beneath it.	Mostly phthisical cavities. Occasionally in solidification of the upper lobe from inflammation or condensation, where the air is suddenly and forcibly expelled through the bronchus, especially if percussed near the sternum.

PART II.

THE PHYSICAL DIAGNOSIS OF DISEASES OF THE LUNGS AND HEART.

TABLE NO. 10.

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
ACUTE PLEURISY. *First Stage.* (Exudation of lymph.)	Diminution in respiratory movements on account of pain. Body bent towards affected side for the same reason.	Sometimes slight dullness.	Feeble. Jerking.
Second Stage. (Effusion of serum.)	Little or no motion of the chest walls on the affected side, but increased motion on the healthy side. Enlargement of side in all directions by measurement, and obliteration of intercostal spaces, especially at lower part of chest.	A sense of resistance, and *flatness* or *dullness* at the base of the chest, terminating abruptly above in a curved line which is not altered by respiration, but which may be made to shift by changing the patient's posture, unless there are adhesions of the pleural surfaces, or the chest is full of liquid. Generally exaggerated resonance above the level of the liquid, and rarely the amphoric or the cracked-metal resonance at the summit.	Feeble, bronchovesicular or bronchial respiration over the compressed lung, with occasionally a feeble, distant, bronchial respiration all over the chest. Respiration generally suppressed below the level of the liquid, but increased on unaffected side during all three stages, especially in this stage.
Third Stage. (Absorption and resolution.)	Mobility of chest walls partially returning, intercostal spaces becoming normal, and enlargement disappearing. After recovery there occurs, in some cases (though seldom in comparison with chronic pleurisy), contraction of the whole side.	The line of flatness is gradually lowered, but dullness often remains for an indefinite time at the base of the chest, where the compression of the lung and the accumulation of solid plastic material is often very great.	Respiration gradually returns to its normal condition from the summit downwards, though feeble often for weeks and months. Absence of respiration at the base frequently remains for a long time.

TABLE NO. 10.

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
Rubbing friction sounds often heard, which are almost pathognomonic when at the middle or inferior part of chest, or all over the side.		Deep-seated tenderness.	When not specified, the signs mentioned in this table are observed over the affected portion of the lung only.
A friction sound is rarely heard even in this stage, where the lung is attached by bands of false membrane to the thoracic walls, and also over the compressed lung higher up.	Lessened or suppressed below the level of the liquid, but increased above. Sometimes bronchophony above the level, or pectoriloquy (especially in pleuropneumonia, or pleurisy with phthisis), heard best over the scapular and interscapular regions on account of the usual situation of the compressed lung. Sometimes ægophony near the level of the liquid.	Fluctuation sometimes apparent. Vocal fremitus lessened or suppressed below the level of the liquid, but increased above. If the heart is displaced, it may be heard and often felt pulsating even to the right of the sternum, or farther to the left than normal in the direction of the axilla; the displacement being to the right if the effusion is on the left side, and to the left if the effusion is on the right side.	Generally the pleural cavity is not more than half or two thirds full in acute pleurisy.
A rasping, grating, creaking, *rough, friction murmur* is now very often observed, especially with a deep inspiration, sometimes loud enough to be heard at a distance, and varying in duration from a very short time to several months, ceasing with adhesion.	Gradually approaches to the normal. Sometimes ægophony.	Sometimes a friction fremitus. The heart, if previously displaced, gradually returns to the præcordia, unless held by morbid adhesions; and curiously enough, the suction force caused by absorption may now even draw it too far in the other direction, — if the effusion has been right-sided, towards the right; if left-sided, further to the left than normal.	

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
CHRONIC PLEURISY. (If the chest is full of fluid.)	Perfect or almost perfect immobility of side of chest (with increase of motion on healthy side). Generally dilatation of side, and as a rule, even if this be not so, the intercostal depressions are effaced or lessened. This is particularly noticeable at the end of inspiration. The maximum enlargement of the side is about two inches. Permanent contraction after recovery.	*Flatness everywhere* on affected side, even extending over the sternum some distance on the other side.	Wanting; except at the summit over or near the compressed lung, where it is bronchial. Exceptionally, however, the bronchial respiration extends over the whole side or the greater part of it. Respiratory murmur exaggerated on healthy side.
EMPYEMA.	The amount of pus is generally even greater than that of the serum in chronic pleurisy, causing still greater dilatation of the chest. The obliteration of intercostal depressions is oftener noticed than in pleurisy.	Same as chronic pleurisy.	Same as chronic pleurisy.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
As in acute pleurisy.	Lessened or suppressed except at the summit behind, where there may be loud and whispering bronchophony and increased vocal resonance. Ægophony is rare.	Fluctuation sometimes apparent. Vocal fremitus lessened or suppressed. Heart displaced even more than is usual in acute pleurisy. Mediastinum displaced laterally. Liver and stomach often displaced downwards, sometimes ascending even higher than before with the contraction accompanying recovery.	If the chest is only partially filled, the signs are the same as in acute pleurisy. It is far more common to have the chest full in chronic than in acute pleurisy.
Same as chronic pleurisy.	Same as chronic pleurisy.	Even more displacement of the heart generally than in chronic pleurisy, it pulsating sometimes even beyond the right nipple. If the left side is affected, the effusion often receives a tangible and visible impulse from the heart's beat; hence the term "pulsating empyema." If a spontaneous perforation takes place through the chest walls, and the skin remains unbroken, the tumor thus formed, besides fluctuating, often has a strong pulsation, synchronous with the systole, simulating aneurism. The tumor may also increase and decrease with respiration.	

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
HYDRO-THORAX.	Although there may be more liquid on one side than on the other, yet there is almost never one-sided dilatation of the chest and displacement of the heart and mediastinum.	Flatness or dullness over the lower part of both sides of the chest. The line of flatness almost always changes with change of posture. Of course it is impossible for both pleural cavities to be completely filled.	As in pleurisy with moderate effusion. There is rarely, however, well-marked bronchial respiration, as, the disease being bilateral, sufficient compression to produce bronchial respiration could not often be compatible with life.
PULMONARY ŒDEMA.		More or less dullness, generally diffused equally over the back of the chest on both sides, and most marked at the lowest parts.	Weakened or suppressed. Rarely well-marked bronchial respiration.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
No exudation of lymph and therefore no friction sounds.	As in pleurisy with moderate effusion.	Vocal fremitus lessened or suppressed below the level of the liquid, but increased above.	Hydrothorax is bilateral; while the different kinds of pleurisy are almost without exception unilateral.
Subcrepitant and fine bubbling râles.	Variable.	Vocal fremitus variable.	Like hydrothorax, pulmonary œdema is a result of structural disease of the heart or kidney. Although generally bilateral, and then oftener found in the posterior portions, it may be unilateral and extend over one lobe or a whole lung.

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
PNEUMO-HYDROTHORAX.	Expansion of affected side and relative mobility impaired. Obliteration and sometimes bulging of intercostal depressions.	*Flatness at the base* of the chest on the affected side, if there be enough liquid (serum or pus). Over the upper part of the same side and sometimes extending beyond the sternum, *tympanitic* resonance almost as intense as that of a tympanitic abdomen. This is heard by conduction even below the level of the liquid, the latter often extending twice as high as the line of flatness. The tympanitic resonance extends over the whole side, if there be only a small amount of liquid. Change of posture always, in this disease, changes relative position of flatness and tympanitic resonance. Sometimes there is amphoric resonance. Dullness from the condensed lung may sometimes be detected at the summit of the chest behind. If the quantity of air or gas be *very* large, on account of the *extreme* tension there may be *tympanitic dullness.*	Suppressed below the level of the liquid. Feeble, distant or suppressed above, unless there is a free communication between the bronchial tubes and the pleural cavity above the level of the liquid, when there may be heard amphoric respiration, limited to a circumscribed area near the perforation, which is generally between the third and sixth ribs on the postero-lateral surface of the chest. Bronchial respiration over the condensed lung (which is generally also tuberculous), at the top of the chest behind. Respiration on healthy side exaggerated.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
Metallic tinkling, and splashing or Hippocratic succussion sound.	Above the liquid amphoric whisper, voice, and cough, if there is amphoric respiration. Or the vocal resonance may be feeble or wanting. Always wanting below the liquid. Metallic tinkling. Increased vocal resonance or bronchophony over the compressed lung at the top of the chest behind.	Vocal fremitus diminished or suppressed. Displacement of heart. Fluctuation. Sense of elasticity above and of resistance below the level of the liquid.	When this disease occurs, it is generally a *complication of phthisis.* The relative proportion of air or gas and water varies in different cases and in the same case at different times, especially if communication with the external air continues.

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
PNEUMO-THORAX.	As in the preceding.	Tympanitic resonance over a part or the whole of the affected side, sometimes even extending to the right or left beyond the sternum.	Respiration suppressed where the air is, or it may be amphoric if there is free communication between the bronchial tubes and the pleural cavity. Bronchial respiration over the condensed lung. Exaggerated on the healthy side.
EMPHYSEMA.	There is a characteristic deformity of the chest, a great bulging of the whole upper part generally, sternum and all. The antero-posterior diameter of the chest is greatly increased. The clavicles are elevated, and yet almost buried up. The lower parts of the scapulæ sometimes project. The entire thorax is dragged upwards as one piece in inspiration, but there is little or no expansion of the chest, because the elasticity of the lung tissue being lost, expiration fails to empty the chest, and there is little room for the introduction of fresh air. Respiratory efforts labored and powerful, yet the breathing is chiefly abdominal, and the lower part of the chest may even sink in during inspiration. Depression above clavicles in inspiration. The patient often stoops from antero-posterior curvature of the spine. In a few cases of the variety called "senile atrophy" of the lung there is no bulging.	Exaggerated resonance (sometimes called vesiculo-tympanitic), on both sides, but generally greater on the left. It is heard over a greater area than the vesicular resonance in health, as the diaphragm is pushed down and the heart is more or less completely covered by lung. Owing to the slight movement of the lungs, this area is not much affected by forced inspiration or expiration. If the lower lobes are emphysematous, the line of hepatic flatness may be lowered to the ninth or tenth rib on the perpendicular mammary line. In exceptional cases, there may be some dullness on percussion.	Weakened or suppressed over the upper lobes, more so usually on the left than on the right side. Inspiratory sound shortened and expiration remarkably prolonged, though of the same quality as in health.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
	Diminished or suppressed where the air is, or amphoric voice, whisper, and cough, if there is amphoric respiration. Vocal resonance increased over the condensed lung, or even bronchophony.	Vocal fremitus diminished or suppressed where the air is, but increased over the condensed lung. Displacement of heart.	A very rare disease, air or gas *without liquid* almost never being found in the chest. *Pneumo-hydrothorax* is often loosely called *pneumo-thorax*, however.
If bronchitis and asthma coexist, bubbling râles, and oftener sibilant and sonorous râles.	Vocal resonance variable.	Vocal fremitus variable. Heart's impulse lowered, sometimes being felt in the epigastrium instead of in the præcordial space. Chest walls unusually elastic to the finger.	In the great majority of cases, vesicular emphysema has associated with it chronic bronchitis. It is often accompanied by paroxysms of asthma. Generally a *bilateral* disease, although there is usually more affection of the left lung than of the right.

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
ASTHMA.	Often a bulging of the upper part of the chest, and a sinking in, during inspiration, of the lower part, on account of the emphysema which generally coexists. Labored respiration.	Owing to the commonly coexisting emphysema, there is generally exaggerated percussion resonance, as in that disease.	Diminished or suppressed. Sometimes exaggerated. Jerking.
BRONCHITIS. (Affecting the larger tubes.)		Healthy resonance on both sides of the chest. A negative sign, but a good one here. Rarely a slight dullness at the lower part of the back of the chest, from excessive secretion which cannot be raised, or from collapse of pulmonary lobules from obstruction of bronchial tubes.	In many cases normal. Sometimes obscured by the râles, sometimes weakened or suppressed over a part of the chest by plugs of mucus in tubes, suddenly reappearing after coughing, sometimes by thickening of the mucous membrane; but from this latter cause both sides are affected alike.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
Loud *sibilant and sonorous râles* with inspiration and expiration (the sibilant, however, being more abundant in inspiration, and the sonorous in expiration), all over the chest on both sides and often heard at a distance. Sometimes *bubbling râles* towards the close of the paroxysms and for several days after, when they cease, unless chronic bronchitis coexists.			The physical signs given are those of a paroxysm. This is generally accompanied by a *temporary* emphysematous condition at least, and by bronchitis. Regular asthmatics often have these for *permanent* complications.
On both sides of the chest, especially over the lower lobes behind, *sonorous and sibilant râles*, according to the size of the tubes in which they are produced, are sometimes heard alone, before secretion takes place, and after this mingled with *coarse and fine bubbling râles*. In many cases *no râles are heard at all*, and when present they often shift their position. The moist râles are not heard unless the mucus is unusually thin and abundant, which is not the case in many instances. They occur oftener in chronic than in acute bronchitis, because in the former the liquid is more apt to be muco-purulent, and therefore produces better bubbles. They occur oftener also in young children than in adults, because the former expectorate less.		Sometimes a rhonchial fremitus.	A bilateral disease.

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
CAPILLARY BRONCHITIS. (Including catarrhal pneumonia.)	If there is considerable collapse of pulmonary lobules, with emphysema, and with or without catarrhal pneumonia, the upper part of the chest is more or less expanded, and the lower part may even sink in during inspiration.	Undiminished resonance on both sides of the chest, except sometimes when there is collapse of pulmonary lobules with or without catarrhal pneumonia, when there may be some circumscribed dullness over disseminated portions of the lung, especially over the lower lobes behind, and exaggerated resonance in other parts, especially the upper part of the chest in front, if emphysema coexists.	Respiration weakened or obscured by râles. If solidification from collapse coexists (with or without catarrhal pneumonia), broncho-vesicular or bronchial or weakened respiration over such parts. If emphysema coexists, weak or suppressed inspiration in front above, and expiration lengthened.
PLASTIC BRONCHITIS. (Pseudo-membranous.)		No dullness unless from collapse, or from great quantity of liquid in bronchi.	There may be suppression of respiration over parts of the chest from the exudation or from collapse; or broncho-vesicular or bronchial respiration from collapse.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
Subcrepitant râles uniformly present on both sides of the chest, with either or both respiratory acts, especially over the lower third of the chest behind. Sibilant and sonorous, especially *sibilant râles*, and also *fine and coarse bubbling râles* may be heard all over the chest on both sides when the smaller and larger tubes are also affected.	If solidification from collapse exists, with or without catarrhal pneumonia, increased vocal resonance or broncho phony over such parts.	If solidification from collapse exists, with or without catarrhal pneumonia, increased vocal fremitus over such parts.	A bilateral disease. Inflammation of the larger tubes generally coexists. Capillary bronchitis is sometimes attended with collapse of pulmonary lobules and catarrhal pneumonia, especially in infants or in aged or feeble persons. Collapse, by the law of compensation, generally gives rise to emphysema in other portions of the lung.
Sonorous and *sibilant râles* on both sides. *Subcrepitant râles* limited to certain portions of chest. Also *bubbling râles.* There may be temporary suppression of râles over parts of the chest from the exudation, or more lasting suppression from collapse.	As in the preceding.	As in the preceding.	A rare disease. The fibrinous exudation commences in the minute branches and extends upwards. A few or many tubes may be affected. Collapse of pulmonary lobules may occur from obstruction. Bilateral disease. Either acute or chronic.

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
ACUTE LOBAR OR CROUPOUS PNEUMONIA. *First Stage.* (Congestion.)	Sometimes costal movements on affected side diminished on account of pain.	There may be a slight dullness.	Weakened somewhat over the congested lobe.
Second Stage. (Hepatization.)	Costal movements diminished on affected side (especially if the whole lung be inflamed), and increased on the other side. There may be in some cases a slight increase by measurement.	Over the affected lobe or lobes increased sense of resistance and marked *dullness*, sometimes even amounting to *flatness*. The interlobar fissure can be distinctly mapped out by percussion, if one or two lobes of the affected lung remain unaffected, the latter giving forth an exaggerated resonance. In such cases the resonance over the healthy lung is increased, but not so much as over these unaffected lobes. In some cases, instead of the usual dullness there may be tympanitic or cracked-metal or amphoric resonance over part of an upper solidified lobe, this quality coming from the air in the trachea or bronchi, conducted by the solidification; also sometimes at the base of the chest, if affected, being conducted upwards from the stomach or colon.	*Broncho-vesicular* followed by *bronchial* respiration, as solidification increases. Exaggerated on healthy side.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
Generally, but not invariably, the *crepitant râle.* When it does occur, it is pathognomonic. Rarely dry and moist bronchial râles from accompanying circumscribed bronchitis, or a friction sound from secondary pleurisy.			Generally a unilateral disease. More common in a lower lobe, especially on the right side. When so situated, the physical signs are best heard in the infra-scapular and infra-axillary regions.
Crepitant râle disappears, but occasionally it persists even in this stage, a few air-cells here and there not being filled with exudation. Rarely moist bronchial râles.	Increased vocal resonance and increased bronchial whisper, followed by *bronchophony* and *whispering bronchophony*, as solidification increases. Occasionally pectoriloquy and whispering pectoriloquy.	Vocal fremitus generally increased over affected portion, but sometimes diminished, and occasionally absent, owing to plugging of bronchi or pleuritic effusion.	Sometimes the heart's sounds are transmitted with peculiar distinctness through the solidification, sometimes not.

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
CROUPOUS PNEUMONIA. *Third Stage.* (1.) Resolution.	Gradual return to the normal condition, and after recovery even contraction may occur in some cases.	Dullness gradually disappears. A little, however, often remains for a long time.	The bronchial merges into the *broncho-vesicular* respiration, which is followed for some time after recovery by weakened respiration.
or			
(2.) Purulent infiltration.		Dullness continues, and becomes more marked.	Bronchial respiration, or feeble or suppressed respiration.
CATARRHAL PNEUMONIA. (Lobular or broncho-pneumonia.)	Already	explained in	connection with
INTERSTITIAL OR CHRONIC PNEUMONIA, OR FIBROID PHTHISIS.	Difference in the relative costal movements on the two sides, and after a while contraction of the affected lobe.	Marked dullness. Occasionally a tympanitic resonance.	Bronchial or broncho-vesicular.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
Subcrepitant râle appears, with sometimes a few fine and coarse bubbling râles. Crepitant râle returns.	Bronchophony and whispering bronchophony, followed by increased vocal resonance and increased bronchial whisper, and this by normal vocal resonance and whisper.	Increased vocal fremitus, followed by the normal.	
Fine and coarse bubbling râles generally in abundance.	Weak bronchophony or diminished vocal resonance.	Vocal fremitus variable.	If, as very rarely happens, an *abscess* forms and discharges, it may give rise to the same physical signs as a phthisical cavity (which see).
Capillary	Bronchitis.		Limited to lobules scattered through lung substance in patches varying in size from a hemp seed to an egg, or larger.
Fine and coarse bubbling râles, also sibilant and sonorous râles.	Increased vocal resonance and increased bronchial whisper. Bronchophony and whispering bronchophony.	Increased vocal fremitus.	Called also Cirrhosis of Lung. It leads to contraction of the lung and dilatation of the bronchi, and is always accompanied by bronchitis. A unilateral disease. Occurs among stone masons, grinders, etc. This disease is "the anatomical basis of almost all pulmonary phthisis."

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
ACUTE MILIARY TUBERCULOSIS.		When one lung is affected a little more than the other, there may be a slight excess of dullness in the former. But oftener there is no notable dullness on either side, the granulations, even when very numerous, remaining isolated.	
PHTHISIS. *First Stage.* (Incipient.)		Some *dullness*, especially if the deposit be at all superficial, at the summit of the chest on one side (more often the left), in front or behind. There may be vesiculo-tympanitic resonance at the apex from secondary lobular emphysema. Remember the *possible very slight dullness in health on the right side.* It is in connection with the diagnosis of incipient phthisis that this fact becomes of the most importance. Any dullness, however slight, at the *left* apex is always abnormal.	Respiration weakened or *broncho-vesicular*, occasionally jerking. [There may be abnormal transmission of the heart sounds (available in the infra-clavicular region), denoting a deposit on the right side, if the first sound be heard better here than on the left; and on the left side, if the second sound be heard better here than on the right.]

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
Subcrepitant, fine and coarse bubbling, and sibilant and sonorous râles in different places all over both sides.			The trouble is apt to be found about equally diffused in both lungs. This disease is liable to be confounded with typhoid fever.
There *may be* one or more of the following kinds of râles: — 1. *Subcrepitant,* indicating a circumscribed capillary bronchitis about the deposit. 2. *Crepitant,* here often called *crackling,* indicating a circumscribed pneumonia. 3. Rubbing *friction* sounds, here often called *crumpling,* indicating a circumscribed dry pleurisy. 4. *Sibilant* râles, indicating a spasm of the tubes, or circumscribed bronchitis. All these râles derive their significance from being heard at the *apex* (oftener the left).	Increased bronchial whisper. Increased vocal resonance. Remember the possible normal disparity.	Increased vocal fremitus.	

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
PHTHISIS. *Second Stage.*	Some flattening and deficient expansion of the upper part of chest on one side. Marked diminution in size of chest by mensuration.	*Dullness*, more or less, at upper part of chest on affected side. Or tympanitic resonance (conducted from bronchi, as there are no cavities yet). There may be exaggerated resonance from coexisting lobular emphysema.	*Bronchial or bronchovesicular* or weakened respiration. Occasionally jerking. (Abnormal transmission of heart sounds.)
Third Stage. (Cavernous.)	Extraordinary prominence of the clavicles from the falling in of upper parts of lung, and deficient expansion. Still greater diminution in size of chest by mensuration.	*Tympanitic* resonance within circumscribed spaces. Occasionally cracked-metal or amphoric resonance. Dullness over the same space, if the cavity is full of morbid products, as, *e. g.*, in the morning before copious expectoration.	*Cavernous* respiration, especially after an abundant expectoration. If the cavities are quite small, the cavernous respiration may be drowned out by the neighboring bronchial respiration, or combined with it, forming a kind of bronchocavernous respiration. Rarely amphoric respiration.
DILATATION OF THE BRONCHI. (Bronchiectasis.)	There *may* be some depression of the chest over the places affected.	Generally dullness from the condensed and contracted parenchyma, and also from accumulation of mucus. Sometimes tympanitic or amphoric resonance, if the tubes are free from morbid products.	Bronchial, if the tubes are cylindrical and unobstructed. Cavernous or amphoric, if saccular and large enough.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
Fine and coarse bubbling râles, from softened deposit or from accompanying circumscribed bronchitis, generally heard better in the morning before much expectoration. Also *sibilant and sonorous râles, friction sounds, and crepitant and subcrepitant râles may be heard.*	Increased vocal resonance and whisper, or *bronchophony and whispering bronchophony.* Occasionally bronchophonic pectoriloquy.	Increased vocal fremitus.	The accompanying signs are observed on the side first affected, generally at the apex. By this time, however, signs denoting a less advanced condition of the disease *may be* heard at the apex of the other side.
Gurgling. Very rarely metallic tinkling.	Sometimes cavernous pectoriloquy and whispering pectoriloquy. Amphoric voice when there is amphoric respiration.	Increased vocal fremitus when the cavity is large, superficial, and has free communication with the bronchi. Sometimes gurgling fremitus. When the disease exists principally in one lung, the shrinking of this lung sometimes drags the heart out of place. Pulsation detected by palpation.	These cavernous signs (to be sought for especially in the upper part of the lung) often have in their vicinity many of the signs of solidification already mentioned.
Bubbling râles from mucus in dilated tubes; sometimes even gurgling, if there is considerable dilatation.	Increased vocal resonance and bronchophony. Sometimes pectoriloquy.	Increased vocal fremitus.	Usually affects many bronchi, and occurs in both lungs. Most common in the lower lobes and the middle lobe of the right lung. Follows bronchitis, collapse of pulmonary lobules, pleurisy, and pneumonia, especially interstitial pneumonia. The dilatation may be of three varieties, — cylindrical, fusiform, or saccular.

TABLE NO. 10, *Continued.*

DISEASE.	INSPECTION AND MENSURATION.	PERCUSSION.	RESPIRATION.
CARCINOMA OF LUNG.	Diminished costal motion. Flattening and contraction of the affected side (if infiltrated). Or the growth may be so great (perhaps four or five pounds) as to enlarge the side. Effacement of intercostal depressions, if pleuritic effusion ensue.	Dullness, often extending beyond the median line, with increased resistance, uniformly extending over a part or the whole of a lung, if infiltrated, but scattered, if there are nodules large enough to produce dullness.	Bronchial or feeble or suppressed. (Suppressed by pressure of cancerous deposit on a large bronchus.) If only one lung is affected, exaggerated respiration over the healthy lung.
INTRA-THORACIC TUMORS. (Especially aneurism.)	There may be a bulging or even perforation of the ribs and sternum, with diminished respiratory movements. Enlargement of chest not as uniform as when enlarged by liquid. Distention of superficial thoracic veins; or of those of one or both upper extremities with œdema; or of those of one or both sides of the neck (significant if there is no tricuspid regurgitation or dilatation of the right heart). Local pulsation, synchronous with heart's systole, sometimes visible in aneurism.	There may be dullness or flatness over the tumor (and over pleuritic effusion or compressed lung if they coexist). The dullness over an aneurism or mediastinal tumor always extends *upwards* and to the right or left; in aneurisms especially to the right. There must not be too forcible percussion over aneurism.	Over the tumor weakened or suppressed from pressure, and bronchial over compressed lung, if there be any.

TABLE NO. 10, *Continued.*

RÂLES.	VOCAL RESONANCE.	PALPATION.	REMARKS.
Bubbling râles, if softening takes place, or if there is secondary bronchitis.	Increased vocal resonance and bronchophony.	Vocal fremitus at first increased, then diminished.	A rare disease. Usually encephaloid and associated with mediastinal cancer. There are two varieties: — 1. *Secondary nodular* deposit, oftener affecting *both* lungs, the nodules varying in size from a pea to an orange. If few, small, and scattered, they may not give rise to any physical signs. 2. *Primary infiltration* into the air-cells, usually affecting *one* lung. Pleuritic effusion often coexists. Softening and excavation may take place.
There may be bubbling râles from secondary bronchitis, or from softening if the tumor is cancerous. There is often, but not always, heard over an aneurism a *systolic murmur*, soft or harsh or roaring, and of variable intensity. Rarely there may be heard also a diastolic murmur, caused by the passage of blood out of the sac.	Vocal resonance variable. Bronchophony over compressed lung tissue, if there be any.	Vocal fremitus diminished or suppressed over tumor. Increased over compressed lung and primary bronchi. Heart pulsations may often be felt out of place in consequence of the pressure. The arteries on one side may be compressed more than on the other. Over aneurism an *impulse* is felt synchronous with the heart's systole, sometimes stronger even than over the heart, sometimes double, either throbbing or undulating. Often a *purring thrill* is felt, generally circumscribed, but sometimes diffused over a large portion of the chest.	These tumors are, in the great majority of cases, *aneurisms;* but sometimes are cancerous, fibrous, or fatty tumors, which generally start from the mediastinum. They often exert great pressure (to their injury, of course) on the heart, lungs, nerves, or vessels, with characteristic symptoms. Tumors may be on one or both sides of chest. Pleuritic effusion may result, also collapse of pulmonary lobules or œdema. Aneurisms arise most commonly from the ascending portion of the arch of the aorta.

TABLE NO. 11.

DISEASE.	AUSCULTATION.	PERCUSSION.
THE HEALTHY HEART.	When heard over the apex, the two healthy heart sounds may be roughly represented by a trochee with dots marking the pauses, thus: —.⌣ . . . The first or systolic is accented, long, booming and of low pitch, and the second or diastolic sound is short and valvular. At the base of the heart the two sounds may more nearly be represented by an iambus ⌣ . — . . ., the second sound being here accented and as long as, if not longer than, the first sound, and more intense. This is because the booming quality, caused by the "element of impulsion" or "muscular element," is not transmitted so far as the valvular element of the first sound.	The space on the surface of the chest beneath which the heart lies is called the *præcordia*, or præcordial region. That part of the præcordia which is uncovered of lung is called the *superficial cardiac space*, and the rest, where lung tissue intervenes between the heart and chest walls, is called the *deep cardiac space*. The boundaries of each of these spaces must be carefully memorized. They are well shown on Plate I. The dullness over the deep cardiac space, though distinct, is of course much less than that over the superficial cardiac space.
PERICARDITIS. *First Stage.* (Exudation of fibrin.)	A characteristic friction sound, often lasting a few hours only, but sometimes for a few days, produced by the rubbing together of the inflamed and roughened pericardial surfaces in the systolic and diastolic movements of the heart. It is either single or double, strictly accompanying or independent of the heart sounds, always superficial, and usually restricted to the præcordial space, — sometimes even to a part of it only. Heard with the greatest intensity on the left edge of the sternum on a level with the fourth rib. Quality grazing, crumpling, creaking, or rasping, and either feeble or loud. Intensity increased by bending the body forward so that the heart is brought nearer the chest walls. Also increased by firm pressure with the stethoscope; also by a full inspiration, the pericardial surfaces being forced nearer together by the expanded lung. A single sound may be made double in this way.	

TABLE NO. 11.

INSPECTION.	PALPATION.	REMARKS.
The apex impulse of the healthy heart can frequently, but not always, be seen in the same place in which it is felt.	The healthy apex beat in the sitting or standing posture is felt in the *fifth* intercostal space, but often in the fourth when lying on the back. It is felt over an area an inch in diameter, from half an inch to two inches to the right of the *linea mammalis* (a vertical line drawn through the left nipple), and about three inches, on an average, to the left of the median line. When lying on the right side, the centre of the area is about half an inch nearer the sternum, and when lying on the left side it is felt on the *linea mammalis*. In some persons the apex beat cannot be felt at all, especially when lying on the right side. It is felt better when on the back, still better when sitting, and best of all when on the left side.	For purposes of comparison, the signs of the healthy heart are placed here. A thorough knowledge of the healthy heart is an absolutely indispensable prerequisite to an understanding of the diseased organ.
Irritable and forcible action of heart.	Forcible action of heart and friction fremitus.	Endocarditis with its physical signs often coexists. Rheumatic pericarditis, which occurs perhaps once in every six cases of rheumatic fever, is almost always accompanied by endocarditis.

TABLE NO. 11, *Continued.*

DISEASE.	AUSCULTATION.	PERCUSSION.
PERICARDITIS. *Second Stage.* (Serous effusion.)	Friction sounds generally (but not invariably) disappear when the effusion becomes considerable; often remaining, however, at the base of the heart near the large vessels, and sometimes being distinctly heard all over the præcordia, in spite of the effusion, by bending the body forwards. *Heart sounds*, especially the first, now *feeble* and *distant*, or *absent* altogether. Absence of respiratory murmur and vocal resonance over the enlarged area caused by the distention of the pericardial sac, the distention pushing the lungs to the right and left. During absorption the friction sounds reappear and may last a week or more; and the heart sounds become more distinct.	With large effusion, the area of præcordial dullness is greatly increased vertically and laterally, and in the upright posture it becomes pyramidal in shape, corresponding to the form of the distended sac, whose base is near the sixth intercostal space, and apex near the sternal notch, and which may extend laterally almost from one nipple to the other. In chronic pericarditis with very large effusion and dilatation of the sac, the dullness or flatness may extend nearly to the axillary and infra-axillary regions on each side. The dullness from the liquid extends below the point of the apex beat. The anterior portion of the sac is mostly uncovered of lung and in contact with the chest walls. When the patient lies down, the lateral diameter of dullness is increased at the expense of the vertical. If the effusion is small, there is merely an increase in the lateral diameter of dullness at the lower portion of the præcordial region in the upright posture. Gradual diminution of the area of dullness as convalescence approaches.
ENDOCARDITIS.	A systolic murmur, generally soft and feeble, due to thickening or roughening of the inflamed endocardium, heard sometimes at the aortic orifice, but usually at the *apex*. The swollen mitral valves with shortened chords may be slightly insufficient, but usually the murmur is *mitral non-regurgitant*, caused by intra-ventricular roughness. Auscultation of the heart should be practiced at the beginning of every case of rheumatic fever, to make sure that there is no old valvular lesion which might be mistaken for a recent endocarditis. If there be an old valvular murmur, there will be more or less cardiac hypertrophy, and the murmur may be loud and rough.	

TABLE NO. 11, *Continued.*

INSPECTION.	PALPATION.	REMARKS.
Arching forward of the præcordial region (mostly in young people, whose costal cartilages are pliable), often extending from the second to the sixth intercostal space. The effusion, if large, restrains the respiratory movement on the left side.	The point of the apex beat raised and carried to the left of its normal position. Friction fremitus disappears. Apex beat *feeble*, or imperceptible, if effusion is large.	Usually the effusion lasts about a week or ten days in acute cases. *Hydropericardium* has physical signs which do not materially differ from those of pericarditis, except that there is no friction sound.
At first the area of the visible impulse of the heart is increased, but later it is apt to be indistinct. Irregular beating.	At first violent and excited action, afterward weakened.	Occurs in the great majority of instances as a secondary affection in the course of acute articular rheumatism. It is more common than pericarditis, with which it is often associated, being far oftener observed without pericarditis than the latter is without it. It may occur in the essential and exanthematous fevers, in pyemia, Bright's disease, diphtheria, etc.

TABLE NO. 11, *Continued.*

DISEASE.	AUSCULTATION.	PERCUSSION.
HYPERTROPHY OF THE LEFT HEART.	First sound loud, dull, and prolonged. Aortic second sound exaggerated, if there are no valvular lesions. Absence or great diminution of vocal resonance over a larger area than normal, showing an enlarged superficial cardiac space. This sign is especially available in females with large breasts, where percussion is difficult.	Extension of percussion dullness to the *left*, and *downwards in the direction of the apex*, especially the latter. Superficial cardiac space increased (the lung being pushed to the left), and greater degree of dullness over it than in health. This increase must not be confounded with that produced by retraction of the lung from its own diseases.
HYPERTROPHY OF THE RIGHT HEART.	First sound loud, dull, and prolonged (except in some cases of extensive emphysema, where the edges of the lungs by overlapping the heart partially muffle the sound), heard with greatest intensity near the ensiform cartilage. Exaggeration of the pulmonary second sound, especially if there is obstruction to the pulmonary circulation. Auscultation of the voice available as in the preceding.	Some extension of dullness to the right of the normal dullness, but not in proportion to the amount of the enlargement of the heart, the increased area of dullness being mostly to the *left*. There is often dullness over the second and third right cartilages near the sternum, owing to the enlarged right auricle.

TABLE NO. 11, *Continued.*

INSPECTION.	PALPATION.	REMARKS.
Increased area of visible impulse, extending over several intercostal spaces and sometimes over the whole of the præcordia. In children there is often an abnormal projection of the præcordial region. Apex beat seen to be lower and farther to the left than normal. If it cannot be seen, it can almost always be felt. If not, it can be located by auscultation.	Apex beat is felt in the sixth, seventh, eighth, or even ninth intercostal space, and to the left of the linea mammalis, the *downward* displacement being especially marked. It is powerful and distinct, though sluggish. A powerful *heaving* movement is felt all over the præcordia.	When the whole heart is hypertrophied, the physical signs of left and right side hypertrophy are combined in varied proportions. In the great majority of cases of cardiac hypertrophy, valvular lesions coexist, and are accompanied by their respective murmurs. When there are no valvular lesions, chronic Bright's disease is the most common cause of left heart hypertrophy.
Increased area of impulse and abnormal projection as above. Strong *epigastric impulse* seen as well as felt, often shaking the lower part of the sternum and extending more or less over the liver.	Apex beat is felt farther to the left generally than in left side hypertrophy (perhaps one, two, or even three inches to the left of the nipple), but not so far *down*, the lower border of the heart being almost horizontal. Apex beat sometimes feeble on account of the apex becoming rounded or blunted. Even then there will be strong impulse in the intercostal spaces above the apex. Powerful *heaving* movement all over the præcordia.	Pulmonary emphysema is the most common cause of right heart hypertrophy, when there are no valvular lesions. If the apex cannot be felt, its location can be ascertained by finding by auscultation the spot where the first sound has the greatest intensity.

TABLE NO. 11, *Continued.*

DISEASE.	AUSCULTATION.	PERCUSSION.
DILATATION OF THE HEART.	First sound short, feeble, and valvular, lacking partially or entirely the element of impulsion or muscular element, thus resembling the second sound. Second sound often inaudible at the apex. Irregular pauses, or intermissions of the beat, especially on exertion. If a murmur has previously existed, its rhythm may become lost, and it may become impossible to say whether it is synchronous with the first or second sound. This is called asystolism. Respiratory murmur diminished in intensity over the upper part of the left lung.	Area of dullness is increased in every direction, especially *laterally,* the transverse diameter greatly exceeding the vertical. The shape of the dullness is *oval* or *square* instead of the normal triangular dullness. An upward and lateral increase of dullness at the base of the enlarged heart indicates dilated auricles.

TABLE NO. 11, *Continued.*

INSPECTION.	PALPATION.	REMARKS.
The area of visible impulse is increased, but it is indistinct. In persons with thin chest walls an undulating motion over the præcordia may be visible.	*Feeble* cardiac impulse. *No heaving* movement, but weak *undulating* motion over the whole præcordia. A queer sensation of rolling over, a kind of diffused tumble against the chest walls followed by a pause. Apex beat not so low as in hypertrophy.	In a great many cases hypertrophy and dilatation are combined in varied proportions, so that we have enlargement with predominating hypertrophy or enlargement with predominating dilatation. Hypertrophy precedes dilatation with rare exceptions; if the enlargement be *very* great, dilatation predominates. From the accompanying physical signs under hypertrophy and dilatation, it can generally be determined which predominates, to what extent, and which side (if either) is more particularly affected. Hypertrophy is more especially the characteristic of the left ventricle, and dilatation of the right ventricle, although either may affect both.

TABLE NO. 11, *Continued.*

DISEASE.	AUSCULTATION.			
	Rhythm of Murmur.	Maximum Intensity of Murmur.	Murmur also heard.	Other things to be noticed.
VALVULAR LESIONS. *I. Left Heart.* AORTIC OBSTRUCTION. (Stenosis.) [2.] Numbers in brackets represent order of frequency according to Walshe.	Systolic.	Second right intercostal space, near the sternum. Exceptionally second left intercostal space near the sternum.	Over the carotids, more or less over the body of the heart, sometimes in the interscapular space near the spinous ridge of the scapula, feebly or not at all at the apex. Transmitted better upwards than downwards.	Murmur generally soft, but may be rough or musical, and it always more or less obscures the first sound of the heart. Aortic second sound weakened and indistinct in proportion to the amount of obstruction. Aortic regurgitation is often associated, when there is a distinct double murmur heard over a large space.

TABLE NO. 11, *Continued.*

PERCUSSION.	INSPECTION.	PALPATION.	REMARKS.
Hypertrophy of the left ventricle is induced after the obstruction has existed for a while, and therefore is found in the majority of cases which come under observation. Finally *dilatation* may ensue. See percussion signs under Left Heart Hypertrophy and Dilatation.	See Left Heart Hypertrophy and Dilatation.	See Left Heart Hypertrophy and Dilatation.	Aortic obstruction is a very common form of heart disease. Besides the very frequent association of aortic regurgitation, it may induce after awhile mitral insufficiency. It is most frequently met with in middle or advanced life. It has to be diagnosticated from an inorganic aortic murmur which is not uncommon in anæmia. This and the other inorganic murmur — the pulmonic — are always *systolic.* The distinguishing features of the *inorganic aortic murmur* are : — Uniformly soft and feeble, not constant, not productive of cardiac enlargement, accompanied by a continuous hum in jugular veins (with sometimes a musical intonation), called "*bruit de diable,*" which is suspended by pressure over the veins with the finger, and by symptoms of anæmia (which is more common among females than males); the aortic second sound as intense as normal, and never accompanied by aortic regurgitation. Sometimes there may be an *innocuous* murmur, not inorganic but produced by mere *roughness* not sufficient to cause obstruction, and consequently not followed by cardiac enlargement.

TABLE NO. 11, *Continued.*

DISEASE.	AUSCULTATION.			
	Rhythm of Murmur.	Maximum Intensity of Murmur.	Murmur also heard.	Other things to be noticed.
AORTIC REGURGITATION. (Insufficiency.) [3.]	Diastolic.	Second right intercostal space (or fourth left costal cartilage), near the sternum.	Diffused over a large area, extending in the direction of the apex or ensiform cartilage, and heard at the sides of the chest and along the spine. Transmitted better downwards than upwards.	Murmur generally soft, but may be rough or musical. It replaces or immediately follows the aortic second sound, which is weakened or suppressed. Aortic obstruction often coexists, when there is a distinct double murmur heard over a large space.
MITRAL OBSTRUCTION. (Stenosis.) [4.]	Presystolic.	At or near the apex.	Over the superficial cardiac space only.	Murmur generally rough, long, and loud, sometimes called "blubbering;" beginning after the second sound and ending abruptly with the first sound. Weakened aortic second sound, and intensified pulmonic second sound, the latter owing to obstruction of the pulmonary circulation.

TABLE NO. 11, *Continued.*

PERCUSSION.	INSPECTION.	PALPATION.	REMARKS.
Great *hypertrophy* and afterwards *dilatation* of the left ventricle are induced. Therefore in the early part of the disease, the percussion signs of the former, and later those of both combined, will be found; finally, if the patient lives long enough, only those of dilatation.	See Left Heart Hypertrophy and Dilatation, especially the latter.	See Left Heart Hypertrophy and Dilatation, especially the latter. Strong, jerking, arterial pulsation felt in superficial arteries all over the body.	Aortic regurgitation is more apt to induce mitral insufficiency than aortic obstruction is. In such cases there may coexist two, three, or even all four of the murmurs of the left side of the heart. There is generally neither dropsy nor dyspnœa in aortic diseases, unless mitral regurgitation coexists.
Dilatation, and often hypertrophy, of the left auricle is first produced, followed by hypertrophy of the right ventricle to overcome the pulmonary obstruction; next, dilatation of the right ventricle; next, dilatation of the right auricle. Finally, not often, but exceptionally, hypertrophy or dilatation of the left ventricle. Percussion signs accordingly.	See Right Heart Hypertrophy and Dilatation, especially the latter.	See Right Heart Hypertrophy and Dilatation, especially the latter. Distinct *purring thrill* over the apex, presystolic in time.	Mitral obstruction is comparatively a rare disease, and, when met with, is oftener found in connection with mitral regurgitation than alone. Still it *may* exist without regurgitation. It is *possible* to have mitral obstruction without a murmur, if the curtains are not adherent at their sides; and on the other hand, Flint says that there may be, rarely, a mitral direct murmur without obstruction when there is also free aortic regurgitation. The orifice is sometimes too small to admit the end of the little finger, whereas in health three fingers can be passed through it. There cannot be much mitral obstruction or regurgitation so long as the aortic and pulmonic second sounds preserve their normal relative intensity.

TABLE NO. 11, *Continued.*

DISEASE.	AUSCULTATION.			
	Rhythm of Murmur.	Maximum Intensity of Murmur.	Murmur also heard.	Other things to be noticed.
MITRAL REGURGITATION. (Insufficiency.) [1.]	Systolic.	At or near the apex.	Over the superficial cardiac space; and unless too feeble, in the left axilla and behind, near the lower angle of the left scapula.	Murmur generally soft, but sometimes rough or musical. Aortic second sound weakened, but pulmonic second sound (heard in the second left intercostal space) often intensified. Where mitral stenosis and regurgitation coexist, there will be one continuous murmur, made up of two elements, presystolic and systolic; the first of which will *not* be conveyed to the left and back. Besides, they almost always differ in pitch and quality.

TABLE NO. 11, *Continued.*

PERCUSSION.	INSPECTION.	PALPATION.	REMARKS.
The same changes take place as in the preceding; and besides, there is always more or less hypertrophy or dilatation of the left ventricle. Percussion dullness increased in every direction.	Area of visible impulse increased.	Impulse forcible or diffused according to the proportion of hypertrophy or dilatation. Apex beat farther to the left than normal. If hypertrophy predominates, it will be lower than if dilatation predominates. Pulse variable in *volume*, and in the later stages also irregular in time.	The commonest of all valvular diseases, especially among the young. It often exists alone, but may have mitral obstruction associated with it. It is almost invariably attended by a murmur, but a *mitral systolic non-regurgitant murmur may be* produced by simple roughening, calcareous deposit, etc., without insufficiency of the valve. The signs which especially distinguish the *regurgitant* from the *non-regurgitant* murmur are the strong pulmonary second sound, the weak aortic second sound existing even with hypertrophy of the left ventricle, the diffusion of the murmur to the left side and to the back, and, after the disease has made some progress, the symptoms of pulmonary congestion. Dyspnœa and dropsy are prominent symptoms of mitral obstruction and regurgitation. Tricuspid regurgitation is often found as a secondary affection in connection with mitral disease.

TABLE NO. 11, *Continued.*

DISEASE.	AUSCULTATION.			
	Rhythm of Murmur.	Maximum Intensity of Murmur.	Murmur also heard.	Other things to be noticed.
II. *Right Heart.* PULMONIC OBSTRUCTION. (Stenosis.) [6.]	Systolic.	Second or third left intercostal space, near the sternum.	Propagated upwards for a short distance towards the left clavicle, but not over the aorta or carotids. Remember that exceptionally an aortic obstructive murmur *may be* heard with greatest intensity at the second or third left intercostal space. The frequency of the aortic murmur and its other characters will generally suffice for a diagnosis.	Second pulmonic sound impaired in intensity. Murmur superficial and may be quite intense. Must be diagnosticated from the *inorganic* pulmonic murmur, which is far more common than the organic, either alone or with the other inorganic murmur—the aortic direct. Inorganic murmurs are always systolic, and almost never occur excepting at the aortic and pulmonic orifices. The inorganic murmur is soft and feeble, with normal heart sounds and no enlargement, not constant, occurs in anæmic persons, especially young females, and is accompanied by the *bruit de diable.*
PULMONIC REGURGITATION. (Insufficiency.) [7.]	Diastolic.	Second or third left intercostal space, near the sternum.	Propagated downwards towards the ensiform cartilage.	Pulmonic second sound impaired in intensity. This murmur, if it were more common, might easily be confounded with an aortic regurgitant murmur, when the pulmonary direct murmur did not co-exist.

TABLE NO. 11, *Continued.*

PERCUSSION.	INSPECTION.	PALPATION.	REMARKS.
Hypertrophy and dilatation of the right ventricle are produced. Percussion signs accordingly.	See Hypertrophy and Dilatation of the Right Ventricle.	See Hypertrophy and Dilatation of the Right Ventricle.	Valvular diseases of the *right heart*, with the exception of tricuspid regurgitation, are so infrequent as to be almost unheard of; so much so, that when the unqualified term "valvular disease" is used, the left heart is always meant. When right-heart lesions exist, they are usually, but not invariably, associated with left-heart lesions, unless they are congenital. Contrary to the rule which prevails *after* birth, the right heart is more commonly affected in prænatal life than the left.
Theoretically, hypertrophy and dilatation of the right ventricle are produced. Percussion signs accordingly.	See Hypertrophy and Dilatation of the Right Ventricle.	See Hypertrophy and Dilatation of the Right Ventricle.	Pulmonic regurgitation is *exceedingly* rare, even more so than pulmonic obstruction. Consequently, the annexed physical signs of it are, to a great extent, theoretical. Tricuspid insufficiency may follow pulmonic obstruction or regurgitation.

TABLE NO. 11, *Continued.*

DISEASE.	AUSCULTATION.			
	Rhythm of Murmur.	Maximum Intensity of Murmur.	Murmur also heard.	Other things to be noticed.
TRICUSPID OBSTRUCTION. (Stenosis.) [8.]	Presystolic.	At lower part of ensiform cartilage.		
TRICUSPID REGURGITATION. (Insufficiency.) [5.]	Systolic.	At lower part of ensiform cartilage.	Generally limited to the superficial cardiac space. If transmitted at all, it is to the right.	A murmur is not present in many cases of actual tricuspid regurgitation, even when there is a definite valvular lesion. Rarely, if ever, rough. Pulmonic second sound diminished in intensity. Mitral or aortic murmurs, or both, often coexist, differing in pitch and quality.

TABLE NO. 11, *Continued.*

PERCUSSION.	INSPECTION.	PALPATION.	REMARKS.
Theoretically, hypertrophy and dilatation of the right auricle are first produced.			The rarest of all.
First the right auricle is dilated, then the right ventricle is hypertrophied and dilated. Then comes enlargement of the left ventricle on account of its increased work. Percussion signs accordingly.	*Jugular pulsation,* synchronous with the heart's systole,—a characteristic sign of tricuspid regurgitation, unless the right ventricle be very weak from dilatation. Larger area of visible impulse than with any other valvular lesion.	Indistinct apex beat unless there is considerable hypertrophy of the left ventricle. Distinct epigastric pulsation.	*Primary* tricuspid regurgitation is very rare; but secondary to mitral stenosis or regurgitation, it is not uncommon. It not infrequently exists in cases where there is no definite lesion of the valve, but where, on account of enlargement of the right heart from mitral disease, the tricuspid orifice is enlarged without a proportionate enlargement of the valve.

TABLE NO. 11, *Continued.*

DISEASE.	AUSCULTATION.	PERCUSSION.
FATTY DEGENERATION OF THE HEART.	Both heart sounds are permanently weakened, especially the *first*. The second sound over the apex is clearer and louder than the first. First sound often *absent*. When present, it is short and valvular, the muscular element or element of impulsion being greatly impaired. This condition is persistent, not temporary; and several examinations must be made before deciding on the diagnosis.	Normal area of dullness as a rule. Sometimes a dilated or hypertrophied heart undergoes fatty degeneration, when, of course, its increased area of dullness will remain.
CARDIAC NEUROSES. (Nervous or functional disorders of the heart.)	Heart sounds healthy in quality, but intensified, clearer, and more abrupt than normal. Occasionally the first sound is metallic, and either may be reduplicated. An inorganic anæmic murmur is sometimes heard at the base of the heart. It is systolic, either aortic or pulmonic or both, soft and feeble, often propagated into the carotids, and accompanied by a hum in the veins of the neck.	Percussion dullness normal. As a mere coincidence, functional disease may exist in a hypertrophied heart.

TABLE NO. 11, *Continued.*

INSPECTION.	PALPATION.	REMARKS.
No visible impulse as a rule, even in thin persons. If there is any, it is very indistinct.	Very little or no apex beat can be felt. If felt it is generally in its normal position, and is irregular or intermittent. If a hypertrophied heart becomes fatty, there is a tumbling, rolling motion.	Valvular lesions may co-exist. The diagnosis of fatty degeneration of a hypertrophied heart is very difficult.
Increased area of visible impulse, which may be seen to be irregular and intermittent at times.	Apex beat in normal position. Increased *action*, not *power*. Beat abrupt and brief. A violent blow, not a powerful heaving. Sometimes impulse weaker than natural.	The physical signs are both negative and positive,—negative in excluding all organic disease, and positive in showing the healthy size, position, and sounds of the heart. Patients with functional disease complain much more of *heart symptoms* than those with organic disease. Inorganic palpitation is increased by sedentary life, organic by exercise.

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